GRADUATE CATALOG 2022-2023

30 Years

of Doctoral Programs

1992-2022

Phone Numbers & Address

If, after reading this *Catalog*, students have further questions or specific inquiries about the programs of, or admission to, The University of North Carolina at Charlotte, they may look below to find the proper office to contact. Correspondence may be addressed to any of the offices by following this format:

The University of North Carolina at Charlotte
Attn: *Department or College*
9201 University City Boulevard
Charlotte, NC 28223-0001

INFORMATION

Campus Operator/Switchboard	**704-687-8622 (UNCC)**
Admissions	
Undergraduate	704-687-5507
Graduate	**704-687-5503**
International	704-687-5503
Summer School	704-687-1283
Adult Students and Evening Services	704-687-5104
Advising Center	704-687-7717
Athletics	704-687-1054
Bookstore	704-687-7050
Bursar	704-687-5506
Colleges	
Arts + Architecture	704-687-0100
Business	704-687-7577
Computing and Informatics	704-687-8450
Education	704-687-8722
Engineering	704-687-8244
Graduate School	**704-687-5503**
Health and Human Services	704-687-8374
Honors College	704-687-7197
Liberal Arts & Sciences	704-687-0088
University College	704-687-5630
Continuing Education	704-687-8900
Counseling and Psychological Services	704-687-0311
Dean of Students	704-687-0345
Dining Services and Meal Plans	704-687-7337
Disability Services	704-687-0040
Distance Education	704-687-1285
Financial Aid	704-687-5504
Health Center	704-687-7400
Housing and Residence Life	704-687-7501
ID Office	704-687-7337
International Programs	704-687-7755
IT Service Desk	704-687-5500
Library	704-687-0494
Niner Central	704-687-5504
Parking and Transportation Services	704-687-0161
Registrar	704-687-5505
Student Engagement/Student Union	704-687-7100
University Career Center	704-687-0795
University Center for Academic Excellence	704-687-7837
University Recreation	704-687-0430
University Scholarship Office	704-687-5871

EMERGENCY NUMBERS

Campus Police -- Emergency	704-687-2200 or 911
Non-Emergency Calls	704-687-8300
Inclement Weather Hotline	704-687-1900

Acknowledgements

This *Catalog* was prepared and published by the Office of Academic Affairs in June 2022. Its goal is to provide a comprehensive, accurate, and useful catalog, which fully describes the academic programs, policies, regulations, and requirements of the University.

Although the publisher of this *Catalog* has made every reasonable effort to attain factual accuracy herein, no responsibility is assumed for editorial, clerical or printing errors, or errors occasioned by mistakes. The publisher has attempted to present information that, at the time of preparation for printing, most accurately describes the course offerings, faculty listings, policies, procedures, regulations, and requirements of the University. However, it does not establish contractual relations. The University reserves the right to alter or change any statement contained herein without prior notice.

We request that omissions and inaccuracies be brought to the attention of the Editor, as well as any suggestions and comments on the presentation and content.

Catalog Compilation
Eric A. Klee and P.J. Frick, Catalog Editors

Cover
Student Photo by Ryan Honeyman, Creative Services Director

The new All-In-C logo was adopted in Fall 2021 and features a block-style letter C with an embedded pickaxe, as used by mascot Norm the Niner.

2022 celebrates 30 years of doctoral programs offered by UNC Charlotte.

Publication Information
Font Type: Oregon LDO

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UNIVERSITY OF NORTH CAROLINA
CHARLOTTE

THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Graduate Catalog
2022-2023
Vol. XIX

Fall 2022, Spring 2023, Summer 2023

https://catalog.charlotte.edu

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UNC CHARLOTTE ♦ 9201 UNIVERSITY CITY BOULEVARD ♦ CHARLOTTE, NC 28223
www.charlotte.edu

Table of Contents

Table of Contents 2
Welcome to UNC Charlotte 3
Academic Calendar 5
Introduction to the Catalog 6
Academic Programs 8
Accreditations 12
About the University 14
The Graduate School 35
Types of Graduate Programs 36
Graduate Student Life 37
Admission to the Graduate School 39
Workplace Competencies 45
University Regulation of Student Conduct 47
Code of Student Academic Integrity 47
Code of Student Responsibility 48
Illegal Drugs and Alcohol Abuse 49
Smoking on University Property 50
Noble Niner Code 51
Degree Requirements and Academic Policies 53
Registration 53
Academic Load/Time Status 59
Course Attendance and Participation 59
Grading 60
Academic Standing 63
Disciplinary Suspension 66
Master's Degree Requirements 66
Ph.D. Degree Requirements 68
DBA Degree Requirements 71
Ed.D. Degree Requirements 73
DNP Degree Requirements 75
Graduate Certificate Requirements 78
Academic Records and Transcripts 79
Family Educational Rights and Privacy Act 79
Financial Information 84
Graduate Tuition and Fees 84
Dining, Housing, and Parking 86
Funding a Graduate Education 87
Payment 89
Refunds 90
College of Arts + Architecture 92
Architecture 92
Music 106
College of Business, Belk 107
Accountancy 108
Business Administration 111
Economics 123
Global Business 127
Management 129
Mathematical Finance 131
Real Estate and Development 135
College of Computing and Informatics 138
Bioinformatics and Genomics 139
Computer Science 144
Computing and Information Systems 148
Software and Information Systems 155
College of Education, Cato 165
Child and Family Studies 167
Counseling 172
Curriculum & Instruction/Middle & Secondary Ed 178
Educational Leadership & School Admin 197
Educational Research, Measurement, Evaluation 205
Elementary Education 207
Foreign Language Education 214
Learning, Design, and Technology 218
Reading Education 222
Special Education 224
Teaching English as a Second Language 234
Urban Education 237
College of Engineering, The William States Lee 240
Civil and Environmental Engineering 242
Construction and Facilities Engineering 251
Electrical Engineering 254
Energy and Electromechanical Engineering 262
Engineering Management 265
Fire Protection and Safety Management 268
Infrastructure and Environmental Systems 270
Mechanical Engineering 275
College of Health and Human Services 283
Applied Physiology, Health, & Clinical Sciences 284
Health Administration 291
Health Services Research 293
Nursing 297
Public Health Sciences 312
Social Work 320
College of Liberal Arts & Sciences 324
Africana Studies 325
Anthropology 327
Biology 329
Chemistry 337
Cognitive Science 339
Communication Studies 340
Criminal Justice 342
English 344
Ethics and Applied Philosophy 358
Gender, Sexuality, and Women's Studies 360
Geography and Earth Sciences 361
Gerontology 376
Health Psychology 378
History 383
Languages and Culture Studies 386
Latin American Studies 393
Liberal Studies 396
Mathematics and Statistics 397
Nanoscale Science 407
Optical Science and Engineering 410
Organizational Science 416
Physics 418
Psychology 420
Public Administration 425
Public Policy 433
Religious Studies 439
Sociology 440
School of Data Science 443
Data Science and Business Analytics 443
Health Informatics and Analytics 446
Course Descriptions (ACCT - WGST) 450
Directory 737
Faculty 737
Emeritus Faculty 793
Glossary 809
Index 823
Campus Map 831

CHARLOTTE

Welcome to UNC Charlotte, North Carolina's urban research university. As you work toward your undergraduate or graduate degree, please think of UNC Charlotte's dedicated faculty and staff as your partners in your success. Their expertise and support, along with the many University resources and services available to you, will enable you to meet your academic, personal, and professional aspirations.

As we emerge from pandemic life, it's so great to see the world opening up and to be able to gather in person. It's amazing how many things we took for granted pre-COVID. Even though the last two years have provided some major challenges and obstacles, I couldn't be more proud of how the members of Niner Nation came together and worked to provide the safest environment possible for all of us, while also implementing creative measures that allowed for a flexible and robust learning environment.

As you embark on your academic career at UNC Charlotte, I hope you will avail yourself of the many services that the University offers. One service that I believe you will find especially helpful in navigating your college experience is Niner Central, which is a one-stop shop for nearly any college-related issue that you can imagine. The physical location for Niner Central is at the front entrance of the Cone University Center. There you will find experts ready to assist with questions related to financial aid, billing/payments, course registration, transcripts, student records, etc. The Niner Central website (ninercentral.charlotte.edu) also contains loads of information in one place to help you get the answers you need as quickly and easily as possible.

I hope you'll also take advantage of the transportation options that are designed to make life more convenient for our campus community. The light rail service on campus connects Niner Nation to Uptown Charlotte and all that it has to offer. And that includes quick and convenient access to the Dubois Center, UNC Charlotte's campus in Center City, which is a hub for a number of our graduate programs. Its prime location also provides the University a place to convene civic, business, and community leaders around thought-provoking topics. Access to these leaders, and connections you may establish with them, could prove valuable to your educational pursuits and career prospects. Part of the transportation fee that you pay ensures your unlimited access to light rail, any city bus or shuttle, the Uptown trolley, and the campus shuttle system, "Niner Transit."

In joining the UNC Charlotte community—Niner Nation—you become part of a community in which students, faculty, and staff work collaboratively to identify and address the needs of the greater Charlotte region. We have a stake in the quality of life of the citizens of the communities we serve, so we constantly are pioneering new ways to drive economic growth and to meet the region's environmental, health, and social needs.

We know that college is more than textbooks and classes, so we encourage you to become actively engaged on campus. Explore all the possibilities available – take advantage of leadership and volunteer opportunities; attend cultural events and lectures; participate in intramural sports; and, of course, we want to see you cheering on your Charlotte 49er athletic teams wherever they might be competing.

I am beyond thrilled to be a part of Niner Nation, and I hope you feel the same way. So once again, welcome! I'm delighted that you've made UNC Charlotte your university of choice. Go Niners!

Sincerely,

Sharon L. Gaber
Chancellor

If this is your first year at UNC Charlotte, welcome to our dynamic community! If you are returning, we are pleased to welcome you back.

You are part of an engaged and enterprising university that is interconnected with North Carolina's largest city. Because we are situated in a diverse, progressive city, our institution is alive with possibilities to learn and grow. Our distinguished faculty are here to provide you with a quality education that will open doors for you. Over the past few years, Niner Nation has proven itself to be a resilient and resourceful community. We have learned how to adjust and adapt. So, no matter what comes our way, we are dedicated to your education and are offering resources through college advising centers and the University Center for Academic Excellence to help you succeed. Please reach out to your academic advisor early and often, as they are here to help you stay on track to meet your goals.

Remember, too, that there is more to the collegiate experience than coursework. I encourage you to become involved in some of the many activities or student organizations. By getting involved, you will build relationships with both your fellow students and our faculty that you will cherish as you move on through the years.

I hope you will take advantage of the excellent resources available here, and explore all that our University has to offer. But don't stop there – explore research, community engagement, and professional development opportunities in the greater Charlotte area and in the world beyond. We're here to help you get started.

We are pleased that you have chosen UNC Charlotte. As our University continues to grow, we look forward to seeing your growth as a person, a scholar, and a future alum.

Sincerely,

Joan F. Lorden
Provost and Vice Chancellor for Academic Affairs

Academic Calendar 2022-2023

UNC Charlotte's academic year is divided into three terms: Fall, Spring, and Summer. These full terms are divided into half terms.

FALL 2022

Aug 15	Academic year begins
Aug 21	New Student Convocation
Aug 22	First day of classes (Full Term & First Half Term)
Aug 27	First day of classes (Saturdays)
Sep 3	No Saturday classes
Sep 5	HOLIDAY: Labor Day
Oct 5	Last day of classes (First Half Term)
Oct 10-11	Fall Recess
Oct 12-13	Final examinations (First Half Term)
Oct 20	First day of classes (Second Half Term)
Oct 31	Registration for Spring 2023 begins
Nov 11	HOLIDAY: Veteran's Day
Nov 23-26	HOLIDAY: Thanksgiving
Dec 7	Last day of classes (Full Term & Second Half Term)
Dec 8	Reading day
Dec 9-15	Final examinations (Full Term & Second Half Term)
Dec 16-17	Fall Commencement

SPRING 2023

Jan 9	First day of classes
Jan 16	HOLIDAY: M.L. King, Jr. Day
Jan 21	First day of classes (Saturdays)
Feb 27 - Mar 4	Spring Break
Mar 27	Registration for Summer 2023 and Fall 2023 begins
Apr 7-8	Refresh Weekend
May 2	Last day of classes
May 3	Reading Day
May 4-11	Final examinations
May 12-13	Spring Commencement
May 15	Academic year ends

SUMMER 2023

May 22 - Jun 28	Summer First Half Term*
May 22 - Aug 10	Summer Full Term*
May 29	HOLIDAY: Memorial Day
Jun 29 - Jul 1	No classes
Jul 4	HOLIDAY: Independence Day
Jul 5 - Aug 10	Summer Second Half Term*

**Dates include final examinations.*

Please note: All dates are subject to change. No classes are held on the above noted holiday dates. A complete list of dates and deadlines is available online from the Office of the Registrar at registrar.charlotte.edu/printable-calendar. Please check this site for the most current information.

AUGUST 2022

S	M	T	W	Th	F	S
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
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SEPTEMBER 2022

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OCTOBER 2022

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30	31					

NOVEMBER 2022

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DECEMBER 2022

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JANUARY 2023

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FEBRUARY 2023

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MARCH 2023

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APRIL 2023

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MAY 2023

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JUNE 2023

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JULY 2023

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30	31					

Introduction to the Catalog

Reader's Guide to the Graduate Catalog

The *University of North Carolina at Charlotte Graduate Catalog* (hereby referred to as the "Catalog") is the official source of the University's academic programs and courses. The Catalog should be used as a guide, in conjunction with an academic advisor, in planning a course of study and in meeting requirements for graduation.

Publication Schedule

The Catalog is published annually in the Spring for the following academic year, which begins in the Fall. Although course offerings and academic requirements at UNC Charlotte are continually under examination and revision, the Graduate Catalog is updated only once per year. This annual revision procedure helps ensure that users of the Catalog will not find unexpected changes during their academic planning processes.

The Graduate Catalog is Divided into Three Major Sections

The first section contains information about the academic calendar, the graduate programs offered, admission to The Graduate School, student conduct, degree requirements and academic regulations, and financial information, including tuition and fees and financial aid.

The second (or curricular) section describes the University's academic programs in detail. The section is organized in alphabetical order by the seven academic colleges, plus the School of Data Science, followed by each individual program, including related courses and their descriptions.

The third and final section contains a faculty directory and glossary of higher education terminology. Rounding out this section is an index which is helpful in locating a topic quickly.

What's New This Year

New Programs

New graduate programs and catalog sections that appear for the first time in this *Catalog* include:

Master's with New Concentrations

- M.Ed. in Curriculum and Instruction with Concentration in Curriculum Leadership
- M.S. in Health Informatics and Analytics with Concentration in Data Science
- M.S. in Health Informatics and Analytics with Concentration in Health Services Outcomes
- M.S. in Mechanical Engineering with Concentration in Machine Learning

Certificates

- Graduate Certificate in Instructional Coaching
- Graduate Certificate in Software Development

Program Changes

Major changes to existing graduate degrees and programs include:

Master's

- M.A. in Spanish with Concentration in Translating and Translation Studies renamed Concentration in Translation and Interpreting Studies

- M.S. in Cybersecurity removed its concentrations
- M.S. in Applied Energy and Electromechanical Systems renamed to Applied Energy and Electromechanical Engineering
- M.S. in Kinesiology with Concentration in Sports Performance renamed Concentration in Strength and Conditioning

Discontinued Programs

Master's

- M.S.E. in Mechanical Engineering

Additional Changes

- New UNC Charlotte logo introduced
- Department of Kinesiology renamed Department of Applied Physiology, Health, and Clinical Sciences
- Classroom Attendance policy changed to Course Attendance and Participation policy and revised

Catalog Policies and Disclaimers

The *UNC Charlotte Graduate Catalog* is not an irrevocable contract. Regulations published in it are subject to change by the University at any time without notice. University regulations are policy statements to guide students, faculty, and administrative officers in achieving the goals of the institution. Necessary interpretations of these policies will be made by the appropriate authorities with the interest of the students and the institution in mind. Students are encouraged to consult an advisor if they have questions about the application of any policy.

The University reserves the right to change any of the rules and regulations of the University at any time, including those relating to admission, instruction, and graduation. The University also reserves the right to withdraw curricula and specific courses, alter course content, change the calendar, and to impose or increase fees. All such changes are effective as proper authorities determine and may apply not only to prospective students, but also to those who are already enrolled in the University.

The requirements specified in this *Catalog* apply to students who commence their studies at the UNC Charlotte during the 2022-2023 academic year and who remain in continuous enrollment at the institution until they graduate. If requirements are changed, students may elect to comply with the new requirements or to remain under the requirements by which they are governed at the time of the change. The choice to apply the new requirements must be declared by students at least one semester prior to graduation through their academic departments.

Students who change their major/minor are bound by the requirements of their new major/minor that are in effect the semester they officially begin studies in the new program.

Students who are readmitted to the University are bound by the program and degree requirements in force at the time of readmission.

Exceptions to these policies may be necessitated by changes in course offerings, degree programs, or by action of authorities higher than the University. In that event, every effort will be made to avoid penalizing the student.

Student Responsibility

Each student is responsible for the proper completion of his or her academic program, for familiarity with the *Catalog*, for maintaining the grade point average required, and for meeting all other degree requirements. Students assume academic and financial responsibility for the courses in which they enroll and are relieved of these responsibilities only by formally terminating enrollment. The advisor will counsel, but the final responsibility remains that of the student.

A student is required to have knowledge of and observe all regulations pertaining to campus life and student behavior. Students are encouraged to familiarize themselves with academic terminology located in the Glossary section of this *Catalog*.

Email is the official form of communication at the University; each student is responsible for checking their charlotte.edu email regularly, as well as maintaining communication with the University and keeping a current address and telephone number on file with the Office of the Registrar.

While associated with the University, each student is expected to participate in campus and community life in a manner that will reflect credibly upon the student and the University. The University has enacted two codes of student responsibility --**The UNC Charlotte Code of Student Academic Integrity** and **The UNC Charlotte Code of Student Responsibility** -- which are summarized in this *Catalog* and available in full online at legal.charlotte.edu/policies/chapter-400. As students willingly accept the benefits of membership in the UNC Charlotte academic community, they acquire obligations to observe and uphold the principles and standards that define the terms of UNC Charlotte community cooperation and make those benefits possible. This includes completion of institutional surveys as requested by the University for program assessment and improvement.

Graduate Academic Programs

COLLEGE AND PROGRAM	GRADUATE DEGREE			
	Certificate	*Master's*	*Doctorate*	*Early Entry Program*
College of Arts + Architecture				
Architecture		MArch, MArch/MUD, MS		Available
Art Education *(interdisciplinary)*	Graduate			
Music – Vocal Pedagogy	Graduate			
Urban Design		MUD, MArch/MUD		
Belk College of Business				
Accountancy		MACC		Available
Business Administration	MBA PLUS Post-Master's	MBA, MBA/MA, MBA/MHA, BA/MSRE	DBA, PhD	
Data Science and Business Analytics *(interdisciplinary)*	Graduate	MS		Available
Entrepreneurship and Innovation	Graduate			
Economics	Graduate	MS, MS/MSc		Available
Global Business and Strategy	Graduate	MBA		
Management		MS		
Mathematical Finance *(interdisciplinary)*		MS, MS/LM, MS/Master's		Available
Organizational Science *(interdisciplinary)*			PhD	
Real Estate	Graduate	MSRE, MSRE/MBA		
College of Computing and Informatics				
Applied Artificial Intelligence	Graduate			
Bioinformatics		MS		Available
Bioinformatics and Computational Biology			PhD	
Bioinformatics Applications	Graduate			Available
Bioinformatics Technology	Graduate			Available
Computer Science		MS, MS/MArch		Available
Computing and Information Systems			PhD	

COLLEGE AND PROGRAM	GRADUATE DEGREE			
	Certificate	*Master's*	*Doctorate*	*Early Entry Program*
College of Computing and Informatics (continued)				
Cybersecurity		MS		
Data Science and Business Analytics *(interdisciplinary)*	Graduate	MS		Available
Game Design and Development	Graduate			
Health Informatics and Analytics *(interdisciplinary)*	Graduate	MS, MHA/MS, MSPH/MS		Available
Human-Computer Interaction	Graduate			
Information Security and Privacy	Graduate			
Information Technology	Graduate	MS, MS/MArch		Available
Network Security	Graduate			
Secure Software Development	Graduate			
Software Development	Graduate			
Cato College of Education				
Advanced Literacy Instruction and Intervention	Graduate			
Anti-Racism	Graduate			
Art Education *(interdisciplinary)*	Graduate			
Child and Family Studies	Graduate	MEd, MAT		
Common Core Instruction	Graduate			
Counseling - Addiction Counseling	Post-Master's	MA		
Counseling - Clinical Mental Health Counseling		MA		
Counseling – School Counseling	Post Master's	MA		
Counselor Education and Supervision			PhD	
Curriculum and Instruction			PhD	
English/Language Arts (Middle Grades and Secondary Education)	Graduate	MEd, MAT		
Mathematics (Middle Grades and Secondary Education)	Graduate	MEd, MAT		
Science (Middle Grades and Secondary Education)	Graduate	MEd, MAT		
Social Studies (Middle Grades and Secondary Education)	Graduate	MEd, MAT		
Teaching English as a Second Language (Middle Grades and Secondary Education)	Graduate	MEd, MAT		
Career and Technical Education (Business, Family and Consumer Services, Marketing, Technology)	Graduate	MAT		
Early Childhood Mental Health	Graduate			
Educational Leadership		MEd	EdD	
Educational Research, Measurement, and Evaluation			PhD	
Elementary Education	Graduate	MEd, MAT		Available
Elementary School Mathematics	Graduate			Available
Foreign Language Education	Graduate	MAT		Available
Instructional Coaching	Graduate			
Learning, Design, and Technology	Graduate	MEd	Ph.D.	Available
National Board Certification	Graduate			
Play Therapy	Graduate			
Reading Education		MEd		Available
School Administration	Post-Master's	MSA		

COLLEGE AND PROGRAM	GRADUATE DEGREE			
	Certificate	*Master's*	*Doctorate*	*Early Entry Program*
Cato College of Education (continued)				
Special Education			PhD	
Academically or Intellectually Gifted	Graduate	MEd		Available
Adapted Curriculum	Graduate	MEd, MAT		
Autism Spectrum Disorders	Graduate			
General Curriculum	Graduate	MEd, MAT		
Substance Abuse Counseling	Graduate			
Teaching English as a Second Language	Graduate	MAT		
Urban Education		MEd		
University and College Teaching	Post-Master's			
The William States Lee College of Engineering				
Applied Energy & Electromechanical Engineering	Graduate	MS		Available
Civil Engineering		MSCE	PhD	Available
Computer Engineering		MS		
Construction and Facilities Engineering		MS		Available
Electrical Engineering		MSEE	PhD	Available
Engineering Management		MS		Available
Engineering, General		MSE		
Fire Protection and Safety Management		MS		
Infrastructure & Environmental Systems *(interdisciplinary)*			PhD	
Mechanical Engineering		MSME	PhD	Available
Optical Science & Engineering *(interdisciplinary)*		MS	PhD	Available
College of Health and Human Services				
Athletic Training		MS		
Health Administration		MHA, MHA/MS, MHA/MBA		Available
Health Informatics and Analytics *(interdisciplinary)*	Graduate	MS, MHA/MS, MSPH/MS		Available
Health Psychology *(interdisciplinary)*			PhD	Available
Health Services Research *(interdisciplinary)*			PhD	
Kinesiology		MS		Available
Nursing				
Applied Nursing Informatics	Graduate			
Nurse Anesthesia Across the Lifespan			DNP	
Nursing – Advanced Clinical Nursing				Available
Adult-Gerontology Acute Care Nurse Practitioner	Post-Master's	MSN		
Family Nurse Practitioner Across Lifespan	Post-Master's	MSN		
Nursing – Systems/Population Nursing				Available
Nurse Administrator	Graduate	MSN		
Nurse Educator	Graduate	MSN		
Community/Public Health Nursing		MSN		
Nursing Practice			DNP	
Public Health	Graduate	MPH, MPH/MS, MPH/MA	PhD	Available
Respiratory Care	Graduate	MS		
Social Work		MSW		

COLLEGE AND PROGRAM	GRADUATE DEGREE			
	Certificate	*Master's*	*Doctorate*	*Early Entry Program*
College of Liberal Arts & Sciences				
Africana Studies	Graduate			Available
Anthropology		MA, MA/MPH		Available
Biology		MS	PhD	Available
Biomedical Sciences	Graduate			
Biotechnology	Graduate			
Chemistry		MS		Available
Cognitive Science	Graduate			
Communication Studies		MA		Available
Criminal Justice	Graduate	MS		Available
Earth Sciences		MS		Available
Emergency Management	Graduate			
English		MA, MA/MFA		Available
Ethics and Applied Philosophy	Graduate	MA		Available
Gender, Sexuality, and Women's Studies	Graduate			
Geography		MA	PhD	Available
Gerontology	Graduate			Available
Health Psychology *(interdisciplinary)*			PhD	Available
History		MA		Available
Infrastructure & Environmental Systems *(interdisciplinary)*			PhD	
Languages and Culture Studies				Available
French	Graduate			Available
German	Graduate			Available
Japanese	Graduate			Available
Russian	Graduate			Available
Spanish	Graduate	MA		Available
Latin American Studies		MA, MBA/MA		Available
Liberal Studies		MA		
Linguistics, Applied	Graduate			
Mathematical Finance *(interdisciplinary)*		MS		Available
Mathematics		MS		Available
Mathematics, Applied			PhD	
Nanoscale Science *(interdisciplinary)*			PhD	
Nonprofit Management	Graduate			
Optical Science & Engineering *(interdisciplinary)*		MS	PhD	Available
Organizational Science *(interdisciplinary)*			PhD	Available
Physics, Applied		MS		Available
Psychology		MA		
Psychology, Industrial/Organizational		MA		
Public Administration		MPA		Available
Public Budgeting and Finance	Graduate			
Public Policy	Graduate		PhD	
Religious Studies		MA		Available
Sociology		MA		Available
Technical/Professional Writing	Graduate			
Urban Management and Policy	Graduate			

COLLEGE AND PROGRAM	GRADUATE DEGREE			
	Certificate	*Master's*	*Doctorate*	*Early Entry Program*
School of Data Science				
Data Science and Business Analytics *(interdisciplinary)*	Graduate	MS		Available
Health Informatics and Analytics *(interdisciplinary)*	Graduate	MS, MPH/MS, MHA/MS		Available
Graduate School				
Workplace Competencies	Graduate			

ACCREDITATIONS

Accreditation is important for the University to be able to receive and distribute state and federal funds. Also, accreditation is important for the acceptance and transfer of college credits. The Office of Institutional Effectiveness and Analytics serves as the accreditation liaison for the University and is responsible for assuring that compliance with accreditation requirements is incorporated into planning and evaluation processes of the institution.

Institutional accrediting bodies conduct comprehensive reviews of institutions of higher education. This review insures that "the institution (1) has a mission appropriate to higher education, (2) has resources, programs, and services sufficient to accomplish and sustain that mission, and (3) maintains clearly specified educational objectives that are consistent with its mission and appropriate to the degrees it offers and that indicate whether it is successful in achieving its stated objectives" (Principles of Accreditation: Foundations for Quality Enhancement). The accreditation granted encompasses the entire institution including all degree programs, instructional sites, and online programs.

UNC Charlotte

UNC Charlotte is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award baccalaureate, master's, and doctorate degrees. Degree-granting institutions also may offer credentials such as certificates and diplomas at approved degree levels. Questions about the accreditation of UNC Charlotte may be directed in writing to the Southern Association of Colleges and Schools Commission on Colleges at 1866 Southern Lane, Decatur, GA 30033-4097, by calling (404) 679-4500, or by using information available on SACSCOC's website (www.sacscoc.org).

College of Arts + Architecture

The Bachelor of Architecture and Master of Architecture are accredited professional degree programs as recognized by the National Architectural Accrediting Board (NAAB).

The Bachelor of Arts in Art, Bachelor of Fine Arts in Art, Bachelor of Fine Arts in Graphic Design, and Bachelor of Arts in Art History are accredited degree programs as recognized by the National Association of Schools of Art and Design (NASAD).

The Bachelor of Arts in Music and Bachelor of Music are accredited degree programs as recognized by the National Association of Schools of Music (NASM).

The Bachelor of Arts in Dance is an accredited degree program as recognized by the National Association of Schools of Dance (NASD).

All arts education programs leading to K-12 licensure (art, dance, music, and theatre education) are accredited by their national accrediting body (the National Association of Schools of Art and Design, National Association of Schools of Dance, National Association of Schools of Music, and National Association of Schools of Theatre) and approved as Educator Preparation Programs by the North Carolina Department of Public Instruction (NCDPI).

College of Business

The programs in business and accounting are accredited by AACSB International, the Association to Advance Collegiate Schools of Business. AACSB International is the premier accrediting agency for bachelor's, master's, and doctoral degree programs in business administration and accounting.

College of Education

The College's professional education programs for BK-12 teachers, counselors, and administrators are approved by the North Carolina Department of Public Instruction (NCDPI) and accredited by the Council for the Accreditation of Educator Preparation (CAEP).

Counseling programs in Counselor Education are accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP).

College of Engineering

The baccalaureate programs in civil, computer, electrical, mechanical, and systems engineering are accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

The civil, electrical, and mechanical engineering technology baccalaureate programs are accredited by the Engineering Technology Accreditation Commission of ABET, www.abet.org.

The construction management baccalaureate program is accredited by the Engineering Technology Accreditation Commission and the Applied and Natural Science Commission of ABET, www.abet.org.

College of Health and Human Services

The baccalaureate degree in nursing/master's degree in nursing/Doctor of Nursing Practice and/or post-graduation APRN certificate at the University of North Carolina at Charlotte is accredited by the Commission on Collegiate Nursing Education (www.ccneaccreditation.org).

The undergraduate nursing programs are approved by the North Carolina Board of Nursing.

The Nursing Anesthesia program is accredited by the Council on Accreditation of Nurse Anesthesia Education Programs (COA).

The Neurodiagnostics and Sleep Science program is accredited by the Commission on Accreditation of Allied Health Education Programs (www.caahep.org) upon the recommendation of the Commission on Accreditation for Polysomnographic Technologist Education (CoA PSG).

The Exercise Science program is accredited by the Commission on Accreditation of Allied Health Education programs (www.caahep.org) upon the recommendation of the Commission on Accreditation for the Exercise Sciences (CoAES).

The Clinical Exercise Physiology concentration of the Master of Science in Kinesiology is accredited by the Commission on Accreditation of Allied Health Education programs (www.caahep.org) upon the recommendation of the Commission on Accreditation for the Exercise Sciences (CoAES).

The Bachelor of Science in Respiratory Therapy (program #500001) and Master of Science in Respiratory Care (program #520001) at UNC Charlotte have been provisionally accredited by the Commission on Accreditation for Respiratory Care (coarc.com). CoARC accredits respiratory therapy education programs in the United States. To achieve this end, it utilizes an 'outcomes-based' process. Programmatic outcomes are performance indicators that reflect the extent to which the educational goals of the program are achieved and by which program effectiveness is documented (coarc.com/students/programmatic-outcomes-data).

The Master of Health Administration program is accredited by the Commission on Accreditation of Healthcare Management Education (CAHME).

The Public Health programs (BSPH, MPH, Ph.D. in Public Health Sciences, and Ph.D. in Health Services Research) are accredited by the Council on Education for Public Health (CEPH).

Both the Bachelor of Social Work (BSW) and the Master of Social Work (MSW) are accredited by the Council on Social Work Education (CSWE).

College of Liberal Arts & Sciences

The Department of Chemistry is on the approval list of the American Chemical Society.

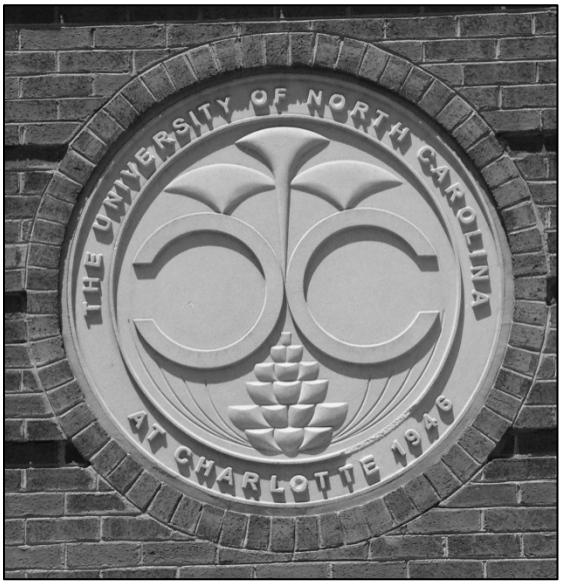
The Public Relations program within the Department of Communication Studies is certified by the Public Relations Society of America (PRSA).

The Clinical Psychology program within the Ph.D. in Health Psychology is accredited by the American Psychological Association (APA).

The Master of Public Administration program is accredited by the National Association of Schools of Public Affairs and Administration (NASPAA).

Graduate School

The University is a member of the Council of Graduate Schools, the Conference of Southern Graduate Schools, and The North Carolina Conference of Graduate Schools.



About the University

northcarolina.edu
charlotte.edu

THE UNIVERSITY OF NORTH CAROLINA SYSTEM

In North Carolina, all of the public educational institutions that grant baccalaureate degrees are part of The University of North Carolina System. The oldest public university system in the nation, UNC traces its roots to the state's 1776 constitution, which held that "All useful Learning shall be duly encouraged and promoted in one or more Universities." Today, nearly 225,000 students are enrolled on 16 university campuses across the state and at the NC School of Science and Mathematics, the country's first public, residential high school for gifted students.

THE UNIVERSITY OF NORTH CAROLINA SYSTEM

History

Chartered by the North Carolina General Assembly in 1789, the University of North Carolina was the first public university in the United States to open its doors and the only one to graduate students in the eighteenth century. The first class was admitted in Chapel Hill in 1795. For the next 136 years, the only campus of the University of North Carolina was at Chapel Hill.

Additional institutions of higher education, diverse in origin and purpose, began to win sponsorship from the General Assembly beginning as early as 1877. Five were historically black institutions, and another was founded to educate Native Americans. Some began as high schools. Several were created to prepare teachers for the public schools. Others had a technological emphasis. One is a training school for performing artists.

The 1931 session of the General Assembly redefined the University of North Carolina to include three state-supported institutions: (1) the campus at Chapel Hill (now the University of North Carolina at Chapel Hill), (2) North Carolina State College (now North Carolina State University at Raleigh), and (3) Woman's College (now the University of North Carolina at Greensboro). The new multi-campus University operated with one board of trustees and one president. By 1969, three additional campuses had joined the University through legislative action: (4) the University of North Carolina at Charlotte, (5) the University of North Carolina at Asheville, and (6) the University of North Carolina at Wilmington.

In 1971, legislation was passed bringing into the University of North Carolina the state's ten remaining public senior institutions, each of which had until then been legally separate: (7) Appalachian State University, (8) East Carolina University, (9) Elizabeth City State University, (10) Fayetteville State University, (11) North Carolina Agricultural and Technical State University, (12) North Carolina Central University, (13) the North Carolina School of the Arts (now the University of North Carolina School of the Arts), (14) Pembroke State University (now the University of North Carolina at Pembroke), (15) Western Carolina University, and (16) Winston-Salem State University. In 1985, the NC School of Science and Mathematics was declared an affiliated school of the University; in July 2007, NCSSM by

legislative action became a constituent institution of the University of North Carolina.

Board of Governors

The UNC Board of Governors is the policy-making body charged with "the general determination, control, supervision, management, and governance" of the University of North Carolina. Its 28 voting members are elected by the NC General Assembly for four-year terms. Former board chairs may continue to serve for limited periods as non-voting members emeriti. The president of the UNC Association of Student Governments or that student's designee is also a non-voting member.

President and UNC System Office

The chief executive officer of the University of North Carolina System is the President. The President is elected by and reports to the Board of Governors. The President's office is the operations level between the constituent institutions and the Board of Governors. The President has complete authority to manage the affairs and execute the policies of the University of North Carolina and its constituent institutions, subject to the direction and control of the Board of Governors.

Chancellors

Each of the UNC campuses is headed by a Chancellor who is chosen by the Board of Governors on the President's nomination and is responsible to the President.

Board of Trustees

Each UNC campus has a local Board of Trustees that holds extensive powers over academic and other operations of its campus on delegation from the Board of Governors.

Shared Governance

The UNC System operates under an arrangement of shared governance that leverages the collective strengths of its campus chancellors and administrators, local boards of trustees, and the UNC President and Board of Governors. The UNC System also honors the important traditional role of the faculty in the governance of the academy.

HISTORY OF THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

UNC Charlotte is one of a generation of universities founded in metropolitan areas of the United States immediately after World War II in response to rising education demands generated by the war and its technology.

To serve returning veterans, North Carolina opened 14 evening college centers in communities across the state. The Charlotte Center opened Sept. 23, 1946, offering evening classes to 278 freshmen and sophomore students in the facilities of Charlotte's Central High School. After three years, the state closed the centers, declaring that on-campus facilities were sufficient to meet the needs of returning veterans and recent high school graduates.

Charlotte's education and business leaders, long aware of the area's unmet needs for higher education, moved to have the Charlotte Center taken over by the city school district and operated as Charlotte College, offering the first two years of college courses. Later the same leaders asked Charlotte voters to approve a two-cent tax to support that college.

Charlotte College drew students from the city, Mecklenburg County and from a dozen surrounding counties. The two-cent tax was later extended to all of Mecklenburg County. Ultimately financial support for the college became a responsibility of the State of North Carolina.

As soon as Charlotte College was firmly established, efforts were launched to give it a campus of its own. With the backing of Charlotte business leaders and legislators from Mecklenburg and surrounding counties, land was acquired on the northern fringe of the city and bonds were passed to finance new facilities. In 1961, Charlotte College moved its growing student body into two new buildings on what was to become a 1,000-acre campus 10 miles from downtown Charlotte.

Three years later, the North Carolina legislature approved bills making Charlotte College a four-year, state-supported college. The next year, 1965, the legislature approved bills creating the University of North Carolina at Charlotte, the fourth campus of the statewide university system. In 1969,

the University began offering programs leading to master's degrees. In 1992, it was authorized to offer programs leading to doctoral degrees.

Today, with an enrollment ranking it fourth among the 17 schools in the UNC system, it is the largest public university in the greater Charlotte metropolitan region. A doctoral institution, UNC Charlotte serves the region through applied research, knowledge transfer, and engaged community service.

More than 1,100 full-time teaching faculty comprise the University's academic departments, and the Fall 2020 enrollment was over 30,000 students, including almost 6,000 graduate students.

MISSION, VISION, AND VALUES OF UNC CHARLOTTE

University Mission Statement

As North Carolina's urban research university, UNC Charlotte is a diverse and inclusive institution with local-to-global impact that transforms lives, communities, and industries through access and affordability, exemplary bachelor's, master's, doctoral, and professional programs, scholarship, creative work, innovation, and service.

University Vision and Values

In fulfilling our mission, we envision a University that promises:

- An accessible and affordable quality education that equips students with intellectual and professional skills, ethical principles, and an international perspective.
- A strong foundation in liberal arts and opportunities for experiential education to enhance students' personal and professional growth.
- A robust intellectual environment that values social and cultural diversity, free expression, collegiality, integrity, and mutual respect.
- A safe, diverse, team-oriented, ethically responsible, and respectful workplace environment that develops the professional capacities of our faculty and staff.

To achieve a leadership position in higher education, we will:

- Rigorously assess our progress toward our institutional, academic, and administrative plans using benchmarks appropriate to the goals articulated by our programs and in our plans.
- Serve as faithful stewards of the public and private resources entrusted to us and provide effective and efficient administrative services that exceed the expectations of our diverse constituencies.
- Create meaningful collaborations among university, business, and community leaders to address issues and opportunities of the region.
- Develop an infrastructure that makes learning accessible to those on campus and in our community and supports the scholarly activities of the faculty.
- Pursue opportunities to enhance personal wellness through artistic, athletic, or recreational activities.
- Operate an attractive, environmentally responsible and sustainable campus integrated with the retail and residential neighborhoods that surround us.

Approved by the Board of Governors on April 11, 2014.

GRADUATION RATE DISCLOSURE STATEMENT

Our data shows that 65.1% of the full-time new freshmen who entered UNC Charlotte in Fall 2014 have received a baccalaureate from UNC Charlotte as of Fall 2020. In addition, another 2.2% were enrolled at UNC Charlotte in pursuit of their baccalaureate degree as of Fall 2020. This information is provided pursuant to requirements of the Student Right-to-Know and Campus Security Act of 1990.

NONDISCRIMINATION

UNC Charlotte seeks to promote a fair, humane and respectful environment for its faculty, staff, students, contractors, and visitors. The University prohibits discrimination and harassment on the basis of race, color, religion, age, national origin, physical or mental disability, political affiliation, veteran status, genetic information, sex, sexual orientation, gender expression, or gender identity in its programs and activities, and in its employment and educational decisions.

If you have discrimination concerns, please see the UNC Charlotte Notice of Nondiscrimination for the contact information of individuals who may assist you. This notice

information of individuals who may assist you. This notice and the University's grievance procedures for making a complaint of discrimination may be found online at legal.charlotte.edu/sites/legal.charlotte.edu/files/media/NondiscriminationNotice.pdf.

UNIVERSITY STRUCTURE

UNC Charlotte is organized into five administrative divisions: Academic Affairs, Business Affairs, Institutional Integrity, Student Affairs, and University Advancement. These divisions, as well as Athletics, all report to the Chancellor.

Academic Affairs

The Division of Academic Affairs provides administrative oversight and academic leadership. It includes Assessment and Accreditation; Enrollment Management; Faculty Affairs and Diversity Office; Institutional Research; International Programs; Library; OneIT; Research and Economic Development; Urban Research and Community Engagement; The Graduate School; Office of Undergraduate Education; and seven discipline-based colleges: the Colleges of Arts + Architecture, Business, Computing and Informatics, Education, Engineering, Health and Human Services, and Liberal Arts & Sciences.

Business Affairs

Business Affairs plans for and provides essential human, financial, facility, and administrative support services to the University that are customer-focused, results-oriented, fiscally sound, and integrity-bound. The Division of Business Affairs includes Business Services; Facilities Management; Financial Services; Human Resources; Safety and Security; and Technical Operations and Planning.

Institutional Integrity

The Division of Institutional Integrity supports UNC Charlotte in its endeavors to achieve its academic mission and strategic plan while adhering to the University's ethical, legal, and regulatory responsibilities. The Division of Institutional Integrity consists of the Office of Legal Affairs, the Office of Ethics and Compliance, the Title IX Office, the Internal Audit Department, and Enterprise Risk Management.

Student Affairs

The Division of Student Affairs advances the educational mission of the University by creating inclusive student-centered learning environments where students excel academically and develop personally into their best selves. The Division of Student Affairs consists of the Center for Counseling and Psychological Services (CAPS), Center for Wellness Promotion, Cone University Center, Dean of Students Office, Housing and Residence Life, Leadership & Community Engagement, New Student and Family Services, Office of Fraternity and Sorority Life, Office of Identity, Equity & Engagement, Popp Martin Student Union, Student Activity Center and Venue Management, Student Affairs Research & Assessment, Student Assistance and Support Services, Student Conduct & Academic Integrity, Student Health Center, Student Involvement, Student Niner Media, University Recreation, Venture Outdoor Leadership, and Veteran Services.

University Advancement

The Division of University Advancement supports the mission of the University by cultivating alumni, community, and government support and affinity, by raising funds for scholarships and major initiatives, by providing and coordinating community engagement opportunities, and by providing broad based communications leadership that articulates the mission of the University to the region, state and nation. The Division includes Alumni Affairs, Community Relations and University Events, Giving and Donor Relations, Government Relations, Advancement Operations, and University Communications.

CAMPUSES

Main Campus

The University of North Carolina at Charlotte is the largest institution of higher education in the Charlotte region and is a genuine urban university. The main campus is in University City, one of the fastest growing areas of the Charlotte region, located off WT Harris Boulevard on NC 49 near its intersection with US 29, and only eight miles from the interchange of Interstates 85 and 77. Campus facilities are comprised of contemporary buildings, including many constructed in the past ten years and more on the way. In addition to classrooms and well-equipped laboratories, the University offers arts and athletic facilities, dining facilities, and residence accommodations. The campus is designed for the pedestrian, and facilities are generally accessible to students with disabilities.

Center City

UNC Charlotte Center City functions as a gateway to the entire University of North Carolina at Charlotte and as such embodies UNC Charlotte's urban identity in the heart of the greater Charlotte region. Architecturally, it reflects its mission as a premier institution of higher education; its context in this vibrant, rapidly urbanizing area; and its commitment to environmental sustainability.

Academically, UNC Charlotte Center City facilitates programs having an urban awareness and context, while providing vital learning opportunities for employees and residents of the urban center. Operationally, it incorporates the attributes we wish to instill in the entire University: excellence in programming, responsiveness to stakeholders, entrepreneurship, interdisciplinary productivity, inclusively, flexibility, and efficiency.

ACADEMIC BUILDINGS

Albert & Freeman

The Energy Production and Infrastructure Center (EPIC) at UNC Charlotte was formed in response to the need from industry to supply highly trained engineers qualified to meet the demands of the energy industry – through traditional and continuing education, and provide sustainable support the Carolina energy industry by increasing capacity and support for applied research. EPIC is a highly collaborative industry/education partnership that produces a technical workforce, advancements in technology for the global energy industry while supporting the Carolinas' multi-state economic and energy security. It was dedicated on November 16, 2012.

In October 2020, the EPIC building was named the Albert & Freeman Energy Production and Infrastructure Center to recognize and honor alumni Craig and Darla Albert. The generosity of the Alberts, especially throughout Exponential: The Campaign for UNC Charlotte, established both the Albert Engineering Leadership Scholars program and the Freeman Scholarship, both housed in the University's Honors College.

The Albert Engineering Leadership Scholars Program invests in superior students who have demonstrated excellence in the areas of academic achievement, leadership and community engagement. Albert Scholars serve as the next generation of leaders who will make dynamic contributions to the field of engineering. The program offers students a full, four-year scholarship, along with academic support and the professional guidance necessary to achieve their educational and professional goals.

The Freeman Scholarship provides renewable scholarship support to students pursuing any major who are eligible for one of the University's honors programs. The Freeman Scholarship is open to incoming first-year students eligible for a Federal Pell Grant or other federal grant aid programs. The scholarship places a strong emphasis on commitment to academics.

Craig Albert earned a bachelor's degree in mechanical engineering from the Lee College of Engineering in 1985 and currently serves as president and chief operating officer of Bechtel Group Inc., the largest engineering and construction firm in the United States. He is responsible for the management and oversight of the firm's global operations and serves on the company's board of directors. Darla Albert earned a bachelor's degree in business administration from UNC Charlotte's Belk College of Business in 1983.

EPIC is home to the Department of Civil and Environmental Engineering and Department of Electrical and Computer Engineering.

Atkins Library

Atkins Library, the third building to be constructed on the UNC Charlotte campus, is named for J. Murrey Atkins, the son of a prominent Gastonia family, successful Charlotte businessman and one of the University's founding members.

Atkins, born in Russellville, Ky., graduated from Gastonia High School. At Duke University, he served as editor of the yearbook and earned a bachelor's degree in 1927. He attended Harvard Law School and Columbia University and spent five years in New York with the Irving Trust Co. before returning to Charlotte. In 1935, he joined the city's leading investment firm R.S. Dickson and Co., where he was president from 1954 until his death.

Atkins was involved with Charlotte College from its inception. He was chair of the college advisory committee for eight years and chair of the Charlotte Community College System when it was authorized in 1958. When UNC Charlotte became a four-year college, he served as chair of the board of trustees.

Sensitive to the social and educational needs of the community, Atkins believed that the Charlotte region needed a public institution of higher learning to stay competitive with other cities in the state. He used his business, financial and political contacts to help Charlotte College become that institution. "Charlotte College was started to meet an emergency and has continued as a necessity," Atkins was fond of saying.

Charlotte College shared a library facility with Central High School. Mozelle Scherger was hired as the first full-time librarian in 1957, when a daytime instructional program was launched. When the college was formally accredited that fall, the number of volumes in the library exceeded 6,000.

Atkins believed the library should be central on the campus, central in student service and the very focal point of learning. When the library was first moved to the new

campus, it was temporarily housed in the W. A. Kennedy Building.

The pioneering leader would not live to see the current library adorned with his name. He died Dec. 2, 1963, and the J. Murrey Atkins Library was dedicated on April 19, 1965. The state legislature appropriated $20.5 million for an expansion in 1995. It was re-dedicated in 2001.

Dalton Library Tower

The Harry L. Dalton Library Tower was completed and dedicated in 1971, and re-dedicated in 2001. It is named in honor of Harry Lee Dalton, distinguished Charlotte business leader and patron of the arts, whose gifts stimulated the development of the Library's Special Collections.

Barnard

The Barnard Building was completed in 1969. It is named in honor of Bascom Weaver Barnard, a founder and first chairman of The Charlotte College Foundation, and first executive director of The Foundation of the University of North Carolina at Charlotte.

Bascom "Barney" Weaver Barnard established the Charlotte College Foundation and served as its first chair. His name features prominently in the early years of UNC Charlotte, and it adorns an 18,000 square-foot building completed in 1969, designed to serve as a facility for instruction and research.

Born Feb. 14, 1894, Barnard was a native of Asheville. He graduated from Trinity College (now Duke University) and completed a master's degree from Princeton University in 1917. He returned to his alma mater, where he taught economics and served as alumni secretary and graduate manager of athletics until 1922. He eventually left academia for the private sector.

Starting in 1939, Barnard worked as an executive for American Commercial Bank (later NCNB, now Bank of America), American Discount Company and the American Credit Corporation while maintaining a busy roster of civic activities. He served on the board the Family and Children Service, the Salvation Army and as chair of the National Affairs Committee of the Charlotte Chamber of Commerce. In 1966, he received one of Charlotte's highest civic honors - the Civitan Distinguished Citizenship Award.

In that same year, Barnard founded Charlotte College Foundation, which by 1971 had raised $4.5 million for the fledgling University; since then, the foundation has since raised significantly more to support scholarship and academic programming at UNC Charlotte. He served as the foundation's secretary and executive director and established the University's Patrons of Excellence Program, which solicited gifts of $10,000 or more from individuals, foundations and corporations.

On May 30, 1971, the UNC Charlotte Academic Council presented Barnard with a resolution stating "Scholarships, professorships, research grants, additions to the library collection, faculty recruitment – all these and more have flourished at his hand. In short, he has helped to provide the margin that leads to excellence." Barnard died Sept. 27, 1980.

The Barnard building is one of the five buildings that make up the original quad of UNC Charlotte. Today, Barnard is home to the Department of Anthropology, Adult Students and Evening Services, and Veteran Student Services.

Bioinformatics

The Bioinformatics Research Center opened in 2009 as a teaching and research building on the campus of the Charlotte Research Institute. It is a multifunctional facility which fosters an interdisciplinary academic and entrepreneurial program. The center also support the nearby "Biopolis" (the North Carolina Research Center) through biotechnology efforts in plant genomics, health, and gene-related research.

The Bioinformatics Building is home to the Department of Bioinformatics and Genomics.

Burson

Sherman Burson Jr. was the first Charles Stone Professor of Chemistry and the inaugural dean of the-then College of Arts and Sciences.

A native of Pittsburgh, Pa., Burson was born Christmas Eve 1923. His father, a Methodist minister, moved the family to Massachusetts, where Burson graduated from Harwich High School. Uncertain of his career goals, Burson considered becoming a surgeon, psychologist or medical researcher.

With little money for college, Burson took the advice of his high school principal and moved South where college costs were lower. He spent the 1941-42 academic year at the University of Alabama. When money ran out, he returned to Pennsylvania, where he worked in a steel mill during the day and attended the University of Pittsburgh at night. World War II was under way, and Burson entered the U.S. Army. A special program enabled him to continue studies at Louisiana State University; following the war, he returned to the University of Pittsburgh, where he completed a bachelor's degree in chemistry. He earned a doctorate in 1953.

In 1957, after nearly five years in private industry, Burson decided to pursue a career in academia. He joined the faculty of Pfeiffer College in Misenheimer. At the urging of Bonnie Cone, Burson accepted a position at Charlotte College in 1963. He was a professor of chemistry and chair of the department when Charlotte College became the fourth campus of the University of North Carolina in 1965. It was under Burson that the department achieved accreditation from the American Chemical Society.

UNC Charlotte's first chancellor, Dean Colvard, appointed Burson acting dean of the College of Science and Mathematics in 1973, and in 1980, Chancellor E.K. Fretwell named him dean of the newly formed College of Arts and Sciences (now the College of Liberal Arts & Sciences), formed by the merger of the College of Science and Mathematics with the College of Humanities and the College of Social and Behavioral Sciences. He held this post until retiring in June 1985.

Completed in summer 1985, the Sherman L. Burson Building was originally dedicated as the Physical Sciences Building. The 104,000-square-foot facility includes a 184-seat tiered lecture hall, a number of smaller lecture halls and laboratory space. Designed by Peterson Associates of Charlotte, the building was constructed by Butler and Sidbury Inc. for a little more than $8 million. At the time of its re-dedication in April 1999, the building was noted for its planetarium platform mounted on vibration-resistant pedestals, an underground Van de Graaf linear accelerator and reinforced concrete radiation labs.

The building's design won a national architectural award and was included in the American School and Universities Architectural Portfolio for 1986.

The Burson building's innovative architecture includes an extremely complex mechanical system which ensures safe exhaust of poisonous and noxious fumes. Today, Burson is home to the Department of Chemistry.

Cameron

The C.C. Cameron Applied Research Center recognizes an individual whose civic and business leadership contributed to the development of UNC Charlotte and the entire UNC system.

Clifford Charles Cameron was born in Meridian, Miss. He later attended Louisiana State University, where he completed a bachelor's degree in chemical engineering in 1941. Following service in World War II, he worked as an engineer for Standard Oil Co. At the urging of a war buddy, Cameron changed careers and became a mortgage banker in 1949. He entered this relatively new field with the creation of Cameron Mortgage Co. in Raleigh. The company merged with Brown-Hamel Mortgage Co. of Greensboro in 1955 and acquired the Carolina Realty Co. of Charlotte. This was the beginning of the Cameron-Brown Co. that would later combine with First Union.

Following that merger, Cameron moved to Charlotte, where he became chief executive officer of First Union in 1968. His affiliation with UNC Charlotte dates to 1967, when Cameron became a member of the board of directors of the UNC Charlotte Foundation. In the early 1980s, Cameron co-chaired UNC Charlotte's first capital campaign and played a leadership role in the University's Silver Anniversary Campaign. He also served as on the UNC Charlotte Board of Trustees and the UNC Board of Governors.

Through his involvement with the UNC Charlotte Foundation, Cameron is credited with helping to create University Place and the subsequent economic development that resulted. He also played a part in the development of the Ben Craig Center.

Chancellor emeritus E.K. Fretwell noted in a magazine article that "Cliff Cameron personifies corporate responsibility… He is giving of his management expertise, his leadership, his great prestige and his personal attention to assist the University of North Carolina at Charlotte in its quest for excellence."

Before retiring as First Union chair in 1984, Cameron laid the groundwork for its growth as one of the nation's top 20 banks. Committed to public service, Cameron served as an advisor to North Carolina governors for four decades. He was a member of Gov. Luther Hodge's Business Development Corp., Gov. Dan Moore's Council for Economic Development; Gov. Bob Scott's Conservation and Development Board and Gov. Hunt's Advisory Budget Commission and Transportation Study Commission. Under Gov. James Martin, Cameron served as an assistant for budget and management.

One of the University's most prestigious scholarships bears the name of C.C. Cameron in recognition of First Union's and his personal contributions that made the financial assistance possible. In honor of his service to the University and the state, UNC Charlotte awarded Cameron an honorary Doctor of Public Service in 1983.

Completed in 1990 and dedicated on Sept. 25, 1991, the Cameron Applied Research Center contained roughly 74,000 square feet of laboratory, office and conference space to support world-class research. At the time, the center was the focal point for the University's outreach

mission to the region. It provided businesses, agencies and organizations access to academic and applied research expertise. A multipurpose facility, the center was designed for maximum flexibility to accommodate evolving research projects. It features clean-room and vibration-free spaces, a 96-seat auditorium and a media center equipped for teleconference and distance learning.

In 2000, the center was renovated and expanded to add roughly 42,000 square feet of space.

Today, the building is known as Cameron Hall and is home to the University Writing Program, Writing Resources Center, and Department of Systems Engineering and Engineering Management.

Cato

Dedicated May 6, 2004, Cato Hall is often the first point of contact for prospective students interested in enrolling at the state's urban research institution. Named for Wayland H. Cato Jr., the building houses Undergraduate Admissions, the Graduate School and the Chancellor's Office, as well as internal audit and legal affairs.

A distinguished business leader and philanthropist, Cato was born in Ridge Spring, S.C., in 1923. His father, Wayland Cato Sr. worked for United Merchants and Manufacturers (UM&M), a New York-based textile conglomerate. The elder Cato moved his family to Augusta, Ga., in 1937, where the younger Cato attended the Academy of Richmond County, a compulsory ROTC military public school. He graduated with honors in 1940.

Cato Jr. enrolled at UNC-Chapel Hill and was elected to Beta Gamma Sigma, a national honorary scholastic commerce fraternity. He also joined the Naval Reserve Officers Training Corps. In 1944, Cato graduated in the top three percent of his class with a bachelor's degree in commerce.

During World War II, he served nearly three years on active duty in the U.S. Navy, stationed aboard minesweepers in the Pacific Theatre.

Following his discharge, Cato joined his father and other family members in Charlotte. The elder Cato had left UM&M to start his own business, which became the Cato Corporation, a chain of women's apparel stores. Cato Jr. became president and chief executive officer of the family business in 1960. He added the title chair of the board of directors in 1970. He retired as chair emeritus in 2004; his son John Cato was named CEO in 1999.

From 1995 to 2002, Cato Jr. was a director of the UNC Charlotte Foundation. Personally and corporately, he endowed a number of scholarship programs at the University. For his leadership in business in the Carolinas and service to the nation, state and community and for his commitment to learning and scholarship, Cato was awarded an honorary Doctor of Humane Letters during commencement in May 2002.

Conceived as the Humanities Office Wing, Cato Hall originally housed Undergraduate Admissions and the Graduate School, along with the Development Office and the departments of Communication Studies and Social Work. The three-story, 32,500-square-foot facility was built for $5.1 million using bonds approved by state voters in 2000 and other University funds.

Today, Cato is home to Graduate and International Admissions; Graduate School; Chancellor's Office; Enrollment Management; Internal Audit; and Legal Affairs.

Colvard

The Colvard Building opened in 1979, and its steel-frame and curtain-wall construction and many energy saving features were considered progressive for its time. Harry Wolf of Wolf Associates designed the structure, and he won the 1980 South Atlantic Regional AIA Honor Award for his work. Among the energy-saving features Wolf utilized were vermiculite insulate roofing, insulated walls and a heat reclaimer. Also, the center arcade was designed for the horizontal and vertical movement of students in a space that did not need to be heated or cooled.

While many of Wolf's design techniques are common today, 30 years ago they were considered forward-thinking. It is appropriate such a building honors Dean Wallace Colvard, UNC Charlotte's first permanent chancellor, a man considered ahead of his time in many respects.

Born in 1913, Colvard was raised in the mountains of western North Carolina in Ashe County. President and salutatorian of his high school class, Colvard was the first member of his family to attend an institution of higher learning. He started at Berea College in 1931, where he earned a scholarship. He also met Martha Lampkin; they would wed in the college's Danforth Chapel in 1939.

After completing his undergraduate degree, Colvard earned a master's degree in endocrinology from the University of Missouri and a doctorate in agricultural economics from Purdue University. He also served as superintendent of North Carolina Agricultural Research Stations from 1938-46. In 1948, Colvard was hired to run North Carolina State University's animal science program. Five years later, he became the dean of agriculture, a post

he held until 1960, when he became president of Mississippi State University (MSU), where he unintentionally became part of college sports history. MSU had won three straight Southeastern Conference championships, but the institution declined to participate in the NCAA tournament rather than integrate, even briefly, on the basketball court. In 1963, Colvard defied a court injunction and allowed the MSU basketball team to compete in the tournament against a team with African-American players.

Colvard returned to his native state in 1966 after being named chancellor of UNC Charlotte. He embraced the challenge of turning a pioneering junior college into a university that had become the fourth member of the consolidated UNC system. As chancellor, he secured regional and national accreditation for University programs, helped create the University Research Park, added graduate programs, expanded the campus and oversaw the growth of the student body from 1,700 to 8,705 students.

He retired Dec. 31, 1978, but Colvard did not leave education behind. He helped build two other institutions: the School of Science and Mathematics at Durham and the hands-on museum Discovery Place. He died June 28, 2007.

Today, Colvard is home to the Departments of Communication Studies, Criminal Justice and Criminology, and Psychological Science; Public Policy program; Office of Undergraduate Education; University Advising Center; University College; Distance Education; Academic Diversity and Inclusion; Summer School; University Center for Academic Excellence; and the Urban Institute.

Cone University Center

Since first opening its doors in 1962, the Cone University Center has been a gathering place for students, faculty, staff, administrators, alumni and guests. As such, it is fitting that the facility bears the name of Bonnie Ethel Cone, the beloved mathematics teacher and visionary administrator who, perhaps more than anyone else, is credited as UNC Charlotte's founder.

Born June 22, 1907, in Lodge, S.C, "Miss Bonnie," as she was affectionately called, taught high school in South Carolina for 12 years before moving to Charlotte's Central High School in 1940. During World War II, she taught math to men enrolled in the navy's V12 program at Duke University, and she spent a year working as a statistical analyst for the Naval Ordnance Laboratory in Washington, D.C.

Cone's background made her the perfect person to head one of the new extension centers established in the late 1940s to serve returning war veterans. Cone directed the Charlotte Center and signed on as a part-time instructor in engineering and math.

Always a firm believer that Charlotte needed a public university, Cone was determined to see one built in the Queen City. She helped turn the temporary veteran's center into a permanent two-year college. In 1963, she played a key role in convincing the North Carolina General Assembly to make Charlotte College a part of the University of North Carolina system. On July 1, 1965, Bonnie Cone stood beside Gov. Dan Moore to ring the bell announcing the official creation of the University of North Carolina at Charlotte.

"Miss Cone has provided the faith on which the college many times found its primary ability to exist," said J. Murrey Atkins in a tribute. "She has stuck with it and never even thought of giving up when sometimes the sledding seemed pretty hard."

Cone served as acting chancellor for nine months and remained committed and loyal to UNC Charlotte. She served as vice chancellor for student affairs and community relations until she retired in 1973. On June 29, as part of her retirement service, the UNC Charlotte Board of Trustees named the University Center in her honor. In retirement, Cone continued to raise money and support the University until her death in 2003.

Today, Cone is home to Niner Central, Center for Graduate Life, University Scholarship Office, Venture, Office of Fraternity and Sorority Life, and Main Street Market.

Denny

In 1965, a new campus facility designed by Odell Associates was completed at a cost of $569,000. F ive years later, the building was dedicated in honor of Mary Rebecca Denny, chair of the UNC Charlotte English Department for 14 years.

Denny was born on Aug. 12, 1896, on the family farm near the small town of Red Springs, N.C. She attended Salem College and taught English in several public schools in eastern North Carolina after completing her bachelor's degree in 1917. She went on to earn a master's degree from Duke University and become associate professor of English at Queens College. She left Queens in 1946 to become the first full-time faculty member at the Charlotte Center of the University of North Carolina (now UNC Charlotte).

Although the Charlotte Center was created to serve in an emergency situation, Denny believed that it would

eventually provide more than a temporary opportunity for its students. She was right as the Charlotte Center became Charlotte College, one of the first two-year community colleges in North Carolina, in 1949.

During the next 15 years, Denny completed an impressive list of initiatives, including the creation of the college newspaper, the literary magazine and the college catalog. When Charlotte College became a four-year institution, Denny relinquished her role as department head, but she remained active with the Curriculum Committee. She retired in 1964, with the distinction of being the institution's first professor emeritus.

At the Oct. 9, 1970, dedication ceremony naming what was then the largest classroom building in her honor, UNC Charlotte trustees enthusiastically paid tribute - "We transform glass, steel and stone into a monument to your spirit – forthright, steadfast, energetic and humanitarian. May this building forever serve as a reminder of your commitment to the ideals of sound scholarship, integrity and excellence."

Following her retirement, Denny returned to her family home in Red Springs, where she resided until her death in 1979.

The Denny building is one of the five buildings that make up the original quad of UNC Charlotte.

Dubois

With the retirement of UNC Charlotte's fourth chancellor in 2020, the University's Center City Building was renamed The Dubois Center at UNC Charlotte Center City (The Dubois Center) to recognize Chancellor Philip L. Dubois and First Lady Lisa Lewis Dubois. The building is regarded as a centerpiece to Dubois' 15-year term as chancellor.

Dubois' career in higher education spans more than 40 years. As a first-generation college student, he earned a bachelor's degree in political science in 1972 from the University of California, Davis, and a master's (1974) and doctoral (1978) degree in political science from the University of Wisconsin-Madison. Dubois returned to the University of California, Davis, to start his career in academia as an assistant professor, rising through faculty and administrative ranks to hold various positions, including full professor and associate vice chancellor for academic programs.

In 1991, Dubois was recruited to UNC Charlotte, where he spent five and a half years as provost and vice chancellor for academic affairs. Under his leadership, UNC Charlotte planned and implemented its first doctoral programs. He led the creation of a strategic academic plan, which included creating programs to reach more nontraditional students, recognizing that as an important goal for an institution founded to educate veterans.

In 1997, Dubois left UNC Charlotte to become president of the University of Wyoming, where he led the development and implementation of comprehensive academic, support services and capital construction plans, expanded the University's role in statewide economic development, and improved student recruitment and retention.

In 2005, Dubois returned to UNC Charlotte and was named chancellor. During his 15-year tenure, he led the University through a 43% growth in enrollment, an expansion of academic programs, the implementation of diversity-related initiatives, growth in research funding and the construction and renovation of campus facilities. He increased the University's visibility in the Charlotte region and beyond, with undergraduate enrollment reaching nearly 30,000 under his leadership, led the largest facility construction and renovation program in UNC Charlotte's history, and under Dubois' strategic direction, football was added to the University's athletics offerings in 2013.

Dubois collaborated with elected officials and the Charlotte Area Transit System to make possible the construction of the light rail line from Center City Charlotte to the UNC Charlotte campus, increasing the connection and opportunities for partnership between the University and the rest of the city. He oversaw the implementation of new academic degree programs — 10 bachelor's, 17 master's, and 12 doctoral — and established or helped in the development of new offices to support students. To reach more non-traditional students, Dubois implemented the award-winning 49er Finish program, which helps students who left the University to complete their degrees, and partnered with Central Piedmont Community College to launch the 49erNext program, which creates a clear path for community college students to enroll at UNC Charlotte. Dubois worked with Charlotte Mecklenburg Schools to create two early colleges at UNC Charlotte, one for students interested in STEM fields and another for those interested in teaching.

The Dubois Center opened in fall 2011 and is the only University of North Carolina classroom building conceived and designed specifically to serve the business, organizations, and people of an urban center. Its 25 state-of-the-art classrooms and design studios accommodate more than 1,300 students annually who earn bachelor's or master's degrees in business, architecture, urban design, education, public administration or health administration, plus about 2,600 more who participate in certificate and other continuing education options. In addition, The

Projective Eye Gallery, located near the lobby, regularly exhibits the work of artists known locally, nationally and internationally.

Duke Centennial

Duke Centennial Hall was dedicated on September 8, 2006, in honor of Duke Energy's century of service and its commitment to leadership for the future.

Duke Energy's history in the Carolinas dates back to 1904, when its first power station was built on the Catawba River. Cheap hydroelectric power helped transform the regional economy from agriculture to manufacturing.

In the 21st Century, our economy continues to change. Duke Energy partnered with UNC Charlotte to help establish the Charlotte Research Institute to advance technology, foster innovation, and drive economic growth in our region.

Today, Duke Centennial is home to the College of Engineering and Department of Mechanical Engineering and Engineering Science.

Fretwell

The E.K. and Dorrie Fretwell Building honors the campus contributions of UNC Charlotte's second chancellor and his wife.

At the time of its dedication on May 23, 1996, the 162,000-square-foot facility was the largest academic structure on campus. It contains approximately 250 faculty offices and classroom seating for about 2,100 students. Built for $18 million, the four-story facility was constructed with revenues from a bond issue approved by North Carolina voters in a November 1993 referendum.

The son of two teachers, E.K. Fretwell was born in New York City. He earned a bachelor's degree at Wesleyan University, a master's in teaching from Harvard University and a doctorate from Columbia University. An Associated Press correspondent, writer for the American Red Cross, vice consul for the American Embassy in Prague and middle and high school teacher, Fretwell entered education administration in 1956 as assistant commissioner for higher education for the New York State Board of Regents. He also served as dean for academic development at the City University of New York and president of the State University of New York College at Buffalo. In addition, he was president of the American Association for Higher Education and chair of the Carnegie Foundation for the Advancement of Teaching.

A national leader in education, Fretwell became UNC Charlotte's second chancellor in January 1979. At the time, the University's enrollment was around 8,700 students. By his retirement in June 1989, UNC Charlotte's enrollment topped 13,000.

During his tenure, Fretwell merged the College of Humanities, Social, and Behavioral Sciences and College of Science and Mathematics into the College of Arts and Sciences (now the College of Liberal Arts & Sciences) and created the Graduate School. Besides enhancing UNC Charlotte's national reputation for educational excellence, Fretwell increased the institution's links to the community through the expansion of the Urban Institute and University Research Park, the development of University Place and establishment of the C.C. Cameron Applied Research Center.

Throughout his career, Fretwell relied upon his wife Dorrie; he was quoted often as saying they were a team. Born in Chicago, Dorrie Shearer Fretwell grew up in Evanston, Ill. She earned bachelor's and master's degrees in applied music at Drake University. Before her marriage, Fretwell studied voice at the American School of Music in Fontainebleau, France, and began her career as a professional soprano, performing as a soloist with choral societies, musical clubs and opera productions on stage and television. During her husband's tenure in Buffalo, Fretwell served as vice chair of the board of the Buffalo Philharmonic Orchestra and vice president of the Girl Scouts. In Charlotte, she was on the board of Opera Carolina and the Charlotte Symphony. Among the initial enrollees of UNC Charlotte's graduate program in clinical psychology, she was its first graduate. She went into practice with Carolina Psychological Services and published a number of articles related to depression and headache management before retiring in 1996. She passed away December 30, 2011.

At the University's formal ceremony to dedicate the E.K. and Dorrie Fretwell Building, Allan Ostar, president emeritus of the American Association of State Colleges and Universities, noted "as a magnificent center of learning, it is a fitting tribute to a towering educational leader."

Today, Fretwell is home to the College of Liberal Arts & Sciences; Departments of English, Mathematics and Statistics, Political Science and Public Administration, and Sociology; American Studies, Liberal Studies, and Women's and Gender Studies programs; and Disability Services.

Friday

The Ida and William Friday Building houses the Belk College of Business, and it honors the many contributions of William C. Friday to the University of North Carolina

system.

Born in Raphine, Va., Friday grew up in the Gaston County town of Dallas, where he played baseball and basketball. He attended N.C. State University, graduating with a bachelor's degree in textile manufacturing. As a senior, Friday met Ida Howell from Lumberton who was pursuing a bachelor's degree in home economics at Meredith College. They married on May 13, 1942, and Bill Friday continued his education at UNC-Chapel Hill where he earned a law degree. Ida Friday also furthered her studies, obtaining a master's in public health from UNC-Chapel Hill.

Friday spent the majority of his career in higher education. He was assistant dean of students at UNC-Chapel Hill, assistant to the president of the Consolidated University of North Carolina and secretary of the University of North Carolina. At age 36, Friday was named acting president of the UNC system. He would lead the system until 1986. During his tenure, he became recognized as one of America's most respected and effective educational leaders. Through the 1963 Higher Education Act, Friday redefined the purpose of each institution of the UNC system (at the time, UNC-Chapel Hill, N.C. State University and UNC Greensboro; UNC Charlotte become the fourth member of the system in 1965). In 1972, he reorganized the entire system which had grown to include 16 campuses (now 17 after the addition of the N.C. School of Science and Mathematics).

On more than one occasion, Friday noted his achievements could not have been possible without his wife, Ida. He said, "It took two of us to do this." As "first lady" of the UNC System, Ida Friday was active in community service, including president of the Chapel Hill Preservation Society, member of the board of the North Carolina Symphony Society, chair of the YMCA and YWCA at UNC-Chapel Hill and a member of the League of Women Voters.

Dedicated in 1982, the Friday Building incorporated the best classroom designs for teaching future business leaders for its time. UNC Charlotte faculty and staff, along with the architect, visited a number of institutions recognized for having leading business programs, including Harvard University, the University of Virginia and the University of Tennessee. The Friday Building's classrooms are modeled after the case classrooms pioneered at the Harvard Graduate School of Business.

The 64,000-square-foot building was designed to accommodate a third floor, which was constructed in 1994-95 using $3 million from a state bond referendum approved by voters in 1993. Changes in the building code required the University to make the facility more earthquake resistant. The columns that grace Friday Building contribute to its distinctive look; they were added during the expansion at the suggestion of Chancellor Emeritus Jim Woodward.

Several other UNC institutions have honored the Fridays with buildings on their campuses, including N.C. State University (the William and Ida Friday Institute for Educational Innovation), UNC-Chapel Hill (the William and Ida Friday Center for Continuing Education) and UNC Wilmington (Friday Hall).

Today, Friday is home to the Belk College of Business and its academic departments and programs.

Gage

The Gage Undergraduate Admissions Center opened for the Fall 2019 semester. The two-story, 18,000-square-foot building welcomes prospective students and their families to campus. Additionally, the Center is home to the Office of Undergraduate Admissions and serves as the starting point for campus tours. This facility was made possible through an estate gift by the late Dr. Lucius G. Gage, Jr.

Dr. Gage was a Charlotte physician and a major benefactor to UNC Charlotte. He passed away in September 2011. He was educated in the Charlotte city schools and entered Duke University for his undergraduate degree after his junior year in high school. He then went on to Duke Medical School where he was recognized for exemplary performance. He completed his residency at the University of Virginia. Gage returned to Charlotte to practice medicine at the Nalle Clinic with his father, the late Dr. Lucius G. Gage, Sr., a founding partner, assuming the Director position in the Allergy and Arthritis Department.

Garinger

Elmer Henry Garinger was one of the visionary leaders who helped Charlotte College realize the dream of becoming a four-year, state-supported institution.

As superintendent of Charlotte City Schools, Garinger employed Bonnie Cone, UNC Charlotte founder, as a mathematics teacher at Central High School. Later, he would name her director of the Charlotte Center of the University of North Carolina, the institution that ultimately became UNC Charlotte.

Born July 13, 1891, in Mount Vernon, Mo., Garinger graduated from the local high school and continued his education at the University of Missouri. He completed a bachelor's degree in 1916, and eventually, he earned a master's degree and doctorate from Columbia University.

During his 40-year career with Charlotte City Schools that began in 1921, Garinger gained a national reputation as a leader in education. In 1949, he was named superintendent of Charlotte City Schools, and he took the lead in planning for the consolidation of the Charlotte and Mecklenburg County school systems, a goal achieved in 1959. Garinger served for a year as superintendent of the new system, retiring as superintendent emeritus.

Garinger's association with UNC Charlotte continued throughout his life. He was instrumental in requesting the Charlotte Center be founded, and he was among the Charlotte leaders who worked to change the Charlotte Center to Charlotte College in 1949. When the institution was placed under the community college system in 1958, Garinger was named secretary of the first Board of Trustees of the Charlotte Community College System; he served in this capacity until 1963, when Charlotte College became a four-year, state-supported institution.

After retiring from the Charlotte-Mecklenburg Schools, Garinger worked to improve public education as a member of the N.C. House of Representatives, where he served two terms. In honor of Garinger's service to public education and the University, UNC Charlotte's Board of Trustees voted to name the first faculty building, constructed in 1965, in his honor. The Elmer Henry Garinger Building was dedicated in October 1970; a portrait of Garinger that hangs in the building was dedicated in March 1987. He died in Charlotte on August 21, 1982.

The Garinger building is one of the five buildings that make up the original quad of UNC Charlotte. Today, Garinger is home to the Departments of Africana Studies and History.

Grigg

Dedicated on Sept. 8, 2006, William H. Grigg Hall is home to a number of Charlotte Research Institute offices and facilities, including the Center for Optoelectronics and Optical Communications.

Named for the chair emeritus of Duke Energy, Grigg Hall is a 96,820-square-foot, state-of-the-art academic and research facility. In 2002, the Duke Energy Foundation announced a $10 million gift to the University's capital campaign in support of Charlotte Research Institute programs and initiatives. Construction of Grigg Hall began in 2003 with funding from the state's $3.1 billion bond referendum approved by North Carolina voters in 2000.

Grigg, who grew up in Albemarle, completed a bachelor's degree from Duke University in 1954. After serving two years in the U.S. Marine Corps, he earned a law degree with distinction from Duke in 1958. After practicing law in Charlotte for five years, Grigg joined Duke Power in 1963 as assistant general counsel. He was promoted to vice president of finance in 1970 and vice president and general counsel in 1971. Elected to Duke Power's board of directors in 1972, Grigg eventually was named vice chair in 1991 and chair and chief executive officer in 1994. He retired in 1997.

During Grigg's tenure with Duke Power, he guided the corporation through some of the most challenging times in the electric utility industry. He helped expand and diversify the company's power plants and led the company's response to competition, including the merger with PanEnergy in 1997 to create Duke Energy. Grigg was named Electric Utility CEO of the Year for 1995 by Financial World magazine.

Committed to civic leadership and quality education, Grigg has served countless community groups, including the Charlotte-Mecklenburg Hospital Authority, Foundation for the Carolinas and the Lynwood Foundation. In honor of his contributions to Charlotte and the greater community, UNC Charlotte awarded Grigg an honorary doctorate of public service in December 1997.

The architectural firm of Perkins-Will, which has offices nationwide, designed Grigg Hall. Constructed for roughly $24 million, Grigg Hall features a 3,000-square-foot clean room, a controlled environmental space used for research and manufacturing. Clean, contamination-free rooms are used in variety of research settings – electronics and optics, as well as pharmaceuticals and DVD manufacturing.

Today, Grigg is home to the Department of Physics and Optical Science and Charlotte Research Institute.

Kennedy

The W.A. Kennedy Building was one of the first two facilities on campus. Designed by A. G. Odell Jr., the architect of Ovens Auditorium and Bojangles Coliseum, the building was named for Woodford A. "Woody" Kennedy. Sometimes called the "spiritual father of Charlotte College," Kennedy was a member of the first advisory board of the institution in 1947. He was named to its eight-member board two years later. Without Kennedy's perseverance, Charlotte College likely would have remained a two-year community college.

Kennedy believed that Charlotte deserved and needed a great university. He stated that a thousand additional high school graduates could go to college each year if the opportunities available in other parts of the state were available in Charlotte. With a zeal he once termed an obsession, Kennedy worked tirelessly to raise money and

support to make that happen.

He encountered a lack of support among many of Charlotte's business executives and disinterest from politicians. His rhetoric sometimes became strident, characterizing critics of the project as naysayers and deriding the state's support as a 'sop.'

At the time, the school operated with a part-time faculty who taught in part-time classrooms, and it was financed almost entirely by tuition paid by student loans until Kennedy pushed for and obtained the initial state funding in 1955.

As a member of the college's site selection committee, he searched for a scenic location with room for growth and expansion; the committee ultimately settled on the present location of the UNC Charlotte campus. He told reporters, "I may not but you will live to see 10,000 students at Charlotte College."

The statement proved prophetic. Kennedy died on May 11, 1958, the eve of his installation as a trustee of Charlotte Community College. But his contribution was not forgotten. The trustees proposed that the first building on the new campus be named for him. The building was dedicated on Feb. 16, 1962.

When Kennedy Building first opened, it housed science laboratories (chemistry, physics, biology and geology), as well as labs for a variety of engineering courses. There were 10 classrooms, 12 faculty offices and a lecture room with elevated seating for 100. The building also served as a temporary library; its first floor contained 18,000 volumes while Atkins Library was being built.

Today, Kennedy houses the Center for Teaching and Learning and Information Technology Services.

King

Arnold K. King may be one of the few individuals to have a building named in his honor on two UNC system campuses. Ten years before UNC Charlotte dedicated the King Building for him, UNC Wilmington put King's name on an administrative and classroom building. Such an honor is an indication of the vital role King played throughout the UNC system.

From his days as a student at UNC-Chapel Hill in the 1920s until his retirement as special assistant to UNC President William Friday, King was an integral part in the development of the University of North Carolina system. After receiving his bachelor's degree, he continued his education at the University of Chicago, completing a master's and doctorate. Returning to Chapel Hill, King served as a professor, graduate school administrator, head of summer sessions and vice president. He also was as acting chancellor for UNC Asheville in 1977.

King participated in a number of education-related study commissions, panels and boards across North Carolina and around the country. UNC President Friday and King were colleagues for more than 20 years. The UNC leader turned to King for his assessment when planning for the system's future. King served as a liaison between Friday and Charlotte College during the institution's transition to becoming the University of North Carolina at Charlotte. He later played the same role for UNC Asheville and UNC Wilmington.

In addition to his long service to the UNC system, King was one of the founders of N.C. Wesleyan College, and he was considered an expert on the history of the UNC system. In retirement, he wrote "The Multi-campus University of North Carolina Comes of Age: 1956-1986," a historical bibliography of his three decades working in the system. He finished a 20-page manuscript on UNC's University Day celebration just two days before his death.

The architectural firm of Odell Associates Inc. designed the building, which was constructed by F.N. Thompson Inc. in 1966 at a cost of $603,000. The King Building was originally named for Addison Hardcastle Reese. It was renamed for King following the dedication of Reese Building, which opened in 1982. Dr. King passed away on March 31, 1992, at the age of 90. A resolution in his memory noted, "Our University lost a part of its memory and conscience, and it lost a great friend."

Today, King is home to the Dean of Students Office, Human Resources, Office of the Registrar, SOAR, and Student Affairs.

Macy

The Macy Building was one of the first two facilities constructed on the UNC Charlotte campus. It was named for Pierre Macy, professor of French and chair of the-then Foreign Language Department. The 18,000-square-foot research and instructional facility was constructed concurrently with the Kennedy Building by Odell Associates in 1961 at a cost of $418,000.

Macy was born in France in 1899 and received degrees from the University of Nancy, the University of Dijon, and the University of Paris before making the United States his adopted home.

The noted author and translator arrived at Charlotte College in 1949 and almost single-handedly established and maintained the fledgling college's Foreign Language

Department (now the Department of Languages and Culture Studies). Before joining the faculty of Charlotte College, Macy was chair of the Romance Language departments at Kentucky Wesleyan College, the University of Tulsa and the College of William and Mary. He returned to his alma mater, the University of Nancy, for one year as a visiting professor.

An integral faculty member of the college, Macy served on the curriculum committee, chaired the concerts and lectures committee, advised the French Club and later served on the University's executive committee.

Students held Macy in such high regard that the 10th edition of the yearbook was dedicated to him in 1960 "for his deep understanding, patient guidance and personal interest in the students of Charlotte College. He has inspired us to greater achievements through his teaching and counseling, and he will be fondly remembered in our memories of Charlotte College."

Macy served as the first commencement marshal for the newly established University. His dedication to UNC Charlotte went well beyond any specific position he held. He taught French three years after relinquishing the department chairmanship and stayed on the faculty two years after he reached retirement age.

At his 1969 retirement, he received the rare honor of being named a faculty emeritus from his colleagues. "The Foreign Language Department, carefully constructed by Dr. Macy over the years was clearly one of the solid blocks of the foundation of the new institution," read the tribute. He is further remembered today with the Pierre Macy Award for Excellence in French.

The Macy building is one of the five buildings that make up the original quad of UNC Charlotte. Today, Macy is home to the Department of Global Studies and Department of Religious Studies.

McEniry

Built to house the University's earth and life sciences programs, the McEniry Building is named for UNC Charlotte's first vice chancellor for academic affairs, William Hugh McEniry. The $4 million, 103,000-square-foot facility was completed July 7, 1975, to house the Departments of Geography and Earth Science and Biology.

Chancellor Dean Colvard hired McEniry (pronounced My-Canary) in 1967; Colvard was searching for a top-notch administrator with an arts and sciences background. Based upon numerous recommendations, Colvard recruited McEniry away from Stetson University where he had spent 27 years and served as a university dean. Ready for a new challenge, McEniry and his wife, Mary, relocated to North Carolina and settled into a 17-acre plot of land between the University and Huntersville they dubbed "Rural Simplicity."

McEniry is credited with recruiting dedicated and talented faculty to UNC Charlotte, and he was active in a number of organizations, such as the North Carolina Association of Colleges and Universities and the College Entrance Board. He also served as president of the Southern Association of Colleges and Schools.

Dedicated to improving higher education for blacks, McEniry served as a trustee of Johnson C. Smith University. In addition, he personally financed scholarships for some black students and worked with the Ford Foundation to improve academics and the curricula for historically black colleges.

In 1973, McEniry agreed to serve as acting chancellor at Western Carolina University in Cullowhee until a permanent chancellor was hired. He passed away on March 15, 1974, at the age of 57.

The McEniry Building is just one lasting tribute to the University's pioneering vice chancellor. Each year, a member of the graduating class with the highest GPA receives the W. Hugh McEniry Award for Academic Excellence. The North Carolina Association of Colleges and Universities named its top honor for the trailblazing educator - the Hugh McEniry Award for Outstanding Service to North Carolina Higher Education. Following McEniry's death, Stetson University established the McEniry Award, a prestigious honor given a professor as selected by faculty members and students.

Today, McEniry is still home to the Department of Geography and Earth Sciences.

Memorial Hall

Memorial Hall is a dedicated to fallen U.S. veterans. The building houses the Departments of Military Science (Army ROTC) and Aerospace Studies (Air Force ROTC). It serves as a memorial to commemorate UNC Charlotte students who have served in any branch of the Armed Services and lost their lives in service to the country.

PORTAL

The Partnership, Outreach, and Research to Accelerate Learning (PORTAL) building, which opened in February 2014, demonstrates UNC Charlotte's commitment to foster partnerships with private industry. Designed to stimulate business growth and job creation along with

promoting research and innovation and supporting the entrepreneurial ecosystem of the Charlotte region, PORTAL is a venue where entrepreneurs can collaborate with peers, faculty members, and students to harness the power of a research university to plan strategies that lead to business success.

PORTAL is outfitted with over 90,000 square feet of floor space dedicated to business innovation and partnership with front door access to the exceptional resources, facilities, and academic talent found on the UNC Charlotte campus. The building has a contemporary aesthetic and 4-story atrium bound by office suites, meeting rooms, and a café. Business tenant offices and suites start at about 200 square feet and are expandable as required. An abundance of naturally lit community gathering spaces – including glass enclosed meeting rooms located on two atrium transecting bridges – facilitate networking and idea exchange. Business tenants have access to any of PORTAL's four meeting rooms on a scheduled basis.

Reese

Around Charlotte, Addison Hardcastle Reese is probably better known as a titan of the banking industry rather than for his passionate commitment to UNC Charlotte.

Born in Baltimore County, Md., on Dec.28, 1908, Reese attended Johns Hopkins University but left after his junior year to begin his lifelong career in banking. He worked as a clerk, a senior national bank examiner and a bank vice president all before serving in the U.S. Air Force during World War II.

Reese returned to banking after the war and was recruited to Charlotte in 1951 as executive vice president of American Trust Company. He was promoted to president in 1954 and organized a series of mergers that became the North Carolina National Bank, which has since evolved into the Bank of America. He also served on the board of the Federal Reserve and as a director of the International Monetary Conference.

Named to the Board of Advisors of the Charlotte Community College System in 1957, Reese was later elected to the college's Board of Trustees. He chaired the Charlotte College Site Committee and worked with University founder Bonnie Cone and Pete McKnight to choose UNC Charlotte's current location.

In 1963, Reese was appointed vice chair of the Charlotte College Board of Trustees and took over as chair following the death of J. Murrey Atkins. He spent a year as a member of the North Carolina Legislative Study Commission on Student Financial Aid and was a member of the UNC Charlotte Foundation.

In 1968, UNC Charlotte awarded its first honorary degrees. One went to Reese and the other went to Frank Porter Graham, former University of North Carolina president, U.S. senator and United Nations mediator.

Reese's award recognized him as "a man of vision, who foresaw a university of excellence, where those of lesser vision saw only a struggling community college."

The North Carolina Citizens Committee presented Reese with the 1974 Distinguished Citizenship Award. Reese also served on the boards of trustees for both the University of North Carolina and UNC Charlotte, serving as the chair of the latter from 1972 until his death in 1977.

Like the Colvard Building, the Reese Administration Building was designed by Harry Wolf of Wolf Associates. It was completed in 1982, and is named in Reese's honor.

Today, Reese houses administrative offices, Bursar's Office, and the Office of Financial Aid.

Robinson

Robinson Hall for the Performing Arts is a state-of-the-art venue that affords the campus and the community access to a slate of contemporary and classical dance, music and theater offerings.

Named for Russell and Sally Dalton Robinson, the three-story, 118,000-square-foot facility contains classrooms, offices and performance and rehearsal spaces for the departments of dance, music and theatre. It was built and equipped for $28 million, financed through the statewide bond referendum approved by voters in 2000.

The hall's first floor houses a 332-seat proscenium theater, which includes a 23-seat orchestra pit. The theatre has a 3,500-square-foot stage equipped with 18 trapdoors, a curtain 26 feet high and a 60-foot fly-loft for storing and changing scenery. There also is the Black Box Theatre. Throughout the building are rehearsal rooms and labs for costume, scenery and lighting design.

The Robinsons are both Charlotte natives, and they are considered among the most admired and effective community leaders. In addition to leadership roles at Christ Episcopal Church, they have supported professional, educational and charitable institutions, arts and cultural organizations and economic development services.

Russell Robinson II is founding partner of one of North Carolina's largest law firms - Robinson, Bradshaw and Hinson. According to an article in the Charlotte Observer, Robinson majored in English at Princeton University but

transferred to Duke University after two years. He went on to obtain his law degree from Duke in 1956. His firm has represented numerous businesses and organizations, including Belk Store Services Inc., the Duke Endowment, Duke Power and the Charlotte Housing Authority. His book "Robinson on North Carolina Corporation Law" is considered a necessity for any aspiring Tar Heel corporate lawyer.

A member of the UNC Charlotte Board of Trustees from 1987-97, Robinson served as chair for eight years. During his board tenure, Robinson was regarded by observers as a "quiet power" for the University; he focused on increasing public and private funding and obtaining UNC system authorization for doctoral degrees beyond joint Ph.D. programs.

In addition to his role as a trustee, Robinson was a director of the UNC Charlotte Foundation. He also has been a trustee of the Duke Endowment and chair of Duke University's Board of Trustees.

Sally Dalton Robinson attended public schools in Charlotte, St. Mary's School in Raleigh and Duke University. She was a member of Phi Beta Kappa and earned a bachelor's degree in history. Among her many civic contributions, she served as an integral founding member of the Levine Museum of the New South and the St. Francis Jobs Program (now the BRIDGE Jobs Program). She also was on the board of the Charlotte Symphony, the Arts and Science Council, McColl Center for the Visual Arts as well as other religious, charitable and economic organizations.

Dedicated November 3, 2004, Robinson Hall was designed by the Charlotte architectural firm of Jenkins Peer. Skanska and R.J. Leeper were general contractors, while the firm Biemann and Rowell was the mechanical contractor. Port City Electric served as the electrical contractor; the hall's lighting and acoustical controls were among the most sophisticated in modern theater design at the time of construction.

Today, Robinson Hall is home to the Departments of Dance, Music, and Theatre; the Anne R. Belk Theater; and the Lab Theater.

Rowe

The Oliver Reagan Rowe Arts Building honors one of UNC Charlotte's founding fathers. Completed in 1971, the 75,000 square-foot facility was constructed to house the-then departments of Performing and Visual Arts. The building's focal point is an eight-sided theatre that seats 350. It also includes a recital hall, classrooms, offices, practice rooms and a large lobby-gallery.

Rowe was born Dec. 12, 1902, in Newport, Tenn. He and his wife Maria would become avid supporters of the Charlotte arts community and UNC Charlotte. Rowe's family moved to Charlotte when he was a child. After graduating from Central High School, Rowe attended UNC-Chapel Hill, where he completed a bachelor's degree in electrical engineering. He returned to Charlotte and began work with the R.H. Bouligny engineering firm. He eventually became president of R.H. Bouligny Inc., Powell Manufacturing Co. and Powell Agri-Systems Ltd.

In the 1950s, Rowe supported consolidation of city and county schools, which won him the Charlotte News "Man of the Year Award" in 1958. That same year, Gov. Luther Hodges appointed Rowe to the first Board of Trustees for the Charlotte Community College System. He chaired the board's finance committee, and he was instrumental in soliciting the largest single gift to the-then Charlotte College Foundation (now the Foundation of the University of North Carolina at Charlotte).

Between 1961 and 1963, Rowe made numerous speeches championing the cause of higher education for the Charlotte region. In 1964, the Charlotte Civitan Club presented its Distinguished Citizenship Award in recognition of Rowe's efforts on behalf of the University.

During the rest of the 1960s, Rowe continued to find new causes for his leadership. A long-time music lover, Rowe began to support the opera and symphony. Eventually, he was elected president of the Charlotte Symphony Orchestra Society, and in 1973, he established, nurtured and financially supported the "Rowe String Quartet" at UNC Charlotte.

In 1987, Rowe was awarded an honorary Doctor of Human Letters. The citation reads in part that "Oliver Reagan Rowe Sr. was a founding father of the University of North Carolina at Charlotte. He helped to dream the dream and to make it come true … With his vision, he painted a picture of a major state university when others around him saw only the two-year college then existing."

Today, the Rowe Building is home to the Department of Art and Art History.

Smith

The Sheldon Phelps Smith Building honors an individual whose foresight helped to chart UNC Charlotte's educational course.

Smith, vice president and general manager of the Douglas Aircraft Company's Charlotte Division, served as a trustee of Charlotte College from 1958 to 1965. He is credited with bringing an engineering program to the institution. Through

his generosity, Douglas Aircraft Co. engineers taught at Charlotte College on a released time basis; as many as nine part-time instructors from Douglas were in service at one time.

Born in Redlands, Calif., on March 26, 1910, Smith graduated from Pomona College in 1932 with a bachelor's degree in physics. During World War II, he served as a lieutenant with the Engineering Division of the Navy Bureau of Aeronautics and was assigned to the missiles branch. Following the war, he was a missile project engineer with the Douglas Aircraft Co. Prior to moving to Charlotte, he was an assistant design engineer for missiles at the company's Santa Monica facility.

In addition to starting the University's engineering program, Smith is credited with bringing graduate courses in mathematics and physics to the-then Charlotte College through a cooperative agreement with N.C. State University.

As an advocate for the college, Smith once said, "If we marry the manpower development of this Charlotte College area of some 1 million people to the tremendous demand of technical industries for engineers and scientists, we will accomplish two ends: to help satisfy the great national requirements for engineers and scientists and to improve the usefulness and economic standards of the residents of North Carolina."

Smith left Charlotte to become vice president of Douglas Aircraft and vice president of Douglas United Nuclear Corp. in Hanford, Wash. He died April 28, 1966.

The Smith Building, completed in 1966, was originally called the Engineering Building. The 71,000 square-foot, $1.6 million facility was the largest classroom and laboratory building on the campus at the time. When finished, it housed the Computer Center, Mathematics Department, the Geography and Geology Department (now Department of Geography and Earth Sciences) and the Engineering Program.

UNC Charlotte dedicated the building in honor of Smith on Dec. 15, 1968, in a ceremony held in the Cone University Center. The Smith family presented a portrait of the building's namesake to be placed in the facility.

The Smith building is one of the five buildings that make up the original quad of UNC Charlotte. Today, Smith is home to the College of Engineering's Office of Student Development and Success and Department of Engineering Technology and Construction Management.

Storrs

The Thomas I. Storrs Building resulted from the collaboration between Charlotte architectural firm Ferebee, Walters and Associates and New York architects Charles Gwaltmey and Robert Siegel.

Since its completion in 1990, Storrs Building has been used as an "architectural education instrument," because students and professionals can study its many unique features, as the building is considered a virtual textbook for use of materials and systems. This 87,000-square-foot facility features a complex roof design, natural and artificial lighting systems, double helix stairs and exposure of structural and environmental systems. Home to the School of Architecture in the College of Arts and Architecture, Storrs Building is appropriately named for an individual who dedicated himself to helping build the University.

Storrs, born in 1918, dropped out of high school during the Great Depression. At the age of 15, he began work as a clerk at the Federal Reserve Bank of Richmond, Va. He would later resume his formal education, enrolling in the University of Virginia, where he completed undergraduate studies. He earned a master's degree and doctorate in economics from Harvard University.

Originally from Nashville, Tennessee, Storrs joined the-then North Carolina National Bank (NCNB) in 1960 as executive vice president. He would later serve as one of the architects who laid the foundation for NCNB to emerge as NationsBank (now Bank of America). Following the retirement of Addison Reese, Storrs became chair and CEO, and he would follow his predecessor's example as a member of the UNC Charlotte Board of Trustees for nearly 12 years – the last four years as chair. His civic involvement included serving as president of the Business Foundation of North Carolina, vice president of the North Carolina Engineering Foundation and director of the North Carolina Textile Foundation. In 1990, he was inducted in the North Carolina Business Hall of Fame.

A recipient of the UNC Charlotte Distinguished Service Award, Storrs also has a scholarship in his name at the University of Virginia.

Formal groundbreaking for the $7.5 million Storrs Building was held Aug. 26, 1988. Dedication of the building was Oct. 29, 1990, and a ceremony to name the facility in honor of Storrs was held Sept. 16, 1992.

Today, the Storrs Building is home to the College of Arts + Architecture and School of Architecture.

Winningham

If one person can be credited for launching the tradition of bringing prominent speakers to the UNC Charlotte campus, then it is Edyth Farnham Winningham, one of the University's pioneering faculty members.

Winningham, born Jan. 26, 1900, in Arthur, N.D., earned a bachelor's degree in modern languages from the University of North Dakota. She later earned a master's in political science from UNC-Chapel Hill, reportedly the first woman in the state to complete the degree.

Beyond teaching high school in North Dakota and North Carolina, Winningham served as a faculty member at the University of Wyoming, the Women's College of the University of North Carolina (now UNC Greensboro) and the UNC College Center in Wilmington (now UNC Wilmington). Her connection to UNC Charlotte dates back to its time as Charlotte College. Winningham joined the faculty in 1947, and she spent the next two decades infecting everyone around her with her passion for politics and international affairs.

Winningham frequently stated that one of her dreams was to bring prominent thought-leaders to the campus to "open up windows" for the institution's students. Her persistence paid off in 1966 with the establishment of the University Forum Council, which sponsored an event each year to bring noted speakers to the campus to address crucial issues facing contemporary society. She chaired the council until spring 1971, despite retiring in 1967 as professor emeritus. According to Special Collections, the final forum was held March 2, 1995. This 30th annual event focused on "Violence: Is Prevention the Key?"

Even after retiring, Winningham continued to lecture on world affairs and international education. She and her husband also established the James and Edyth F. Winningham Scholarship for undergraduate political science majors.

In 1970, Winningham's service to the greater Charlotte community was recognized by the League of Women of Voters. The organization singled her out for her instrumental role in forming closer ties between the University and the Charlotte community at large, and she was named WBT Radio's Woman of the Year. In 1985, UNC Charlotte awarded her an honorary Doctor of Humane Letters. She died May 27, 1994.

The 10,507-square-foot classroom building which bears her name was constructed in 1965 by F.N. Thompson Inc.; the architectural firm Odell Associates designed the facility.

The Winningham building is one of the five buildings that make up the original quad of UNC Charlotte. Today, Winningham is home to the Department of Philosophy.

Woodward

As students at UNC Charlotte attend classes in the science and technology building on campus, they are walking into the physical manifestation of the work done by Chancellor Emeritus James Woodward and his wife Martha. On November 16, 2005, the building was formally dedicated to recognize the Woodwards' 16 years of service and devotion to the University.

The James H. and Martha H. Woodward Hall is a direct result of their vision to help elevate UNC Charlotte to a research institution. The Woodwards worked together to raise awareness of the University's vital role as an economic engine and build many new partnerships and friendships for the institution. As Chancellor from 1989 to 2005, Jim Woodward was the visionary, strategist, and master builder who guided UNC Charlotte's development as a major research institution. Martha played a vital role in strengthening ties to UNC Charlotte through the hosting of thousands of guests regionally and nationally. Throughout their 16 years at the University, the Woodwards worked together to bring much needed attention to both the University's strengths and to its resource needs.

Today, Woodward Hall is home to the College of Computing and Informatics; and Departments of Biological Sciences, Computer Science, and Software and Information Systems.

UNIVERSITY LOGO

In 2021, UNC Charlotte adopted the All-in-C logo, which features a block-style letter C with a pickaxe (used by Charlotte mascot Norm the Niner). The design pays tribute to the University's trailblazing spirit. The All-in-C represents the power to break new ground, the persistence to discover the unknown, and the promise to build the future.

UNIVERSITY SEAL

UNC Charlotte became the fourth campus of the University of North Carolina in July of 1965. In the fall of 1965, the new UNC Charlotte seal was chosen by a committee of students (the three upper-class presidents),

three faculty members, and the school publicity director, who served as chair. Final approval was given by Acting Chancellor Bonnie Cone.

UNC Charlotte seal's elements are: the modern arches (the tulip design from the canopy of the Kennedy Building) at the top to symbolize that this is a twentieth century university; two Cs in the middle to represent Charlotte College, from which the new campus sprang; and the pine cone at the bottom for the Old North State [land of the longleaf pine]. The date on the seal is 1946, the year in which the institution began as the Charlotte Center of the University of North Carolina.

ALMA MATER

UNC Charlotte's Alma Mater has deep roots in the institution's history. It was part of an "Academic Festival March" composed for UNC Charlotte by James Helme Sutcliffe, a Charlotte composer and music critic who lived in Germany at the time. Dr. Loy Witherspoon, professor of religious studies, commissioned the March in 1965 when he learned that Charlotte College would become a campus of The University of North Carolina. The March was first performed in 1967 at the installation of Dean W. Colvard as UNC Charlotte's first chancellor. Afterwards, it was performed as a recessional at every Commencement during Dean W. Colvard's tenure as chancellor. When UNC Charlotte founder Bonnie Cone heard the March, she said, "I can hear an alma mater in it," referring to a hymn-like refrain. Dr. Robert Rieke, a professor of history, also heard an alma mater in it.

On a 1990 trip to Germany, Rieke visited Sutcliffe, picked up a recording of the March, and began writing words to fit the final refrain. On Christmas Eve 1991, he sent Bonnie Cone the words and music as a Christmas present to her and to the University, from which he had retired a year earlier. Chancellor James H. Woodward approved the composition as the University's Alma Mater in April 1992. It was sung for the first time at the following May Commencement and has been performed at every Commencement since.

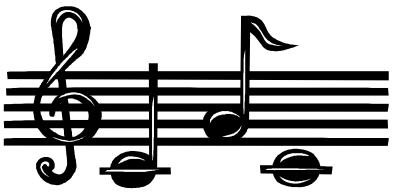
THE 49ERS

The nickname, the 49ers, was chosen in recognition of the importance of the year 1949 in the history of the University. UNC Charlotte, which began as an off-campus center of the University of North Carolina at Chapel Hill, would have closed its doors in 1949 had Bonnie Cone and her supporters not convinced the N.C. Legislature that Charlotte needed a permanent college. Charlotte College was established that year. Additionally, the campus is located on N.C. Highway 49, and Charlotte has a rich gold mining history -- the term "49ers" symbolizes gold mining. A bronze statue of the 49ers Gold Miner sits at the bottom of the staircase between the College of Education and College of Health and Human Services buildings on campus. The statue recalls the region's history as a gold mining center and symbolizes the pioneering spirit and determination that has led to UNC Charlotte's dramatic growth.

49ERS FIGHT SONG

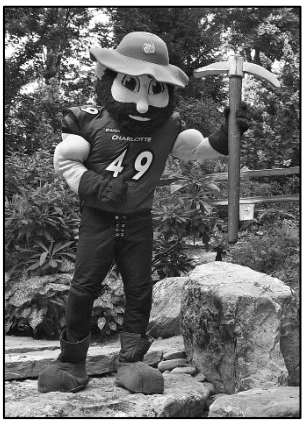
The fight song music was composed by former music faculty member Dr. Harry Bulow in 2001. It replaced one which belonged to the University of Texas at Austin, entitled "Texas Fight," which had been used since the late 1960's. The new fight song was played for five years before Dr. Laurence Marks, UNC Charlotte's director of bands, composed a set of lyrics in 2006. Minor changes suggested by the campus administration, Athletics, and students were accepted by Marks and submitted for final approval by the Chancellor and the 49ers Fight Song, reflected below, was born.

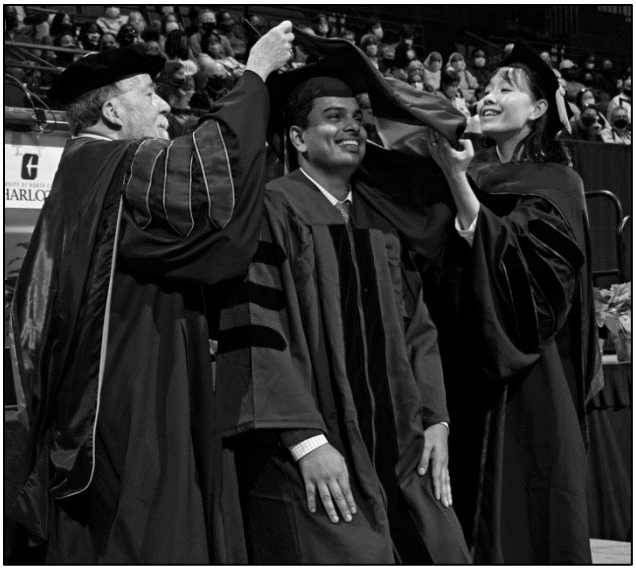
Hail, Charlotte 49ers, proud as we can be
We stand to fight for the green and white,
Til we win the Victory (Go Niners!)
We pledge our trust in you,
And wave your colors high
The loyal Niner Nation cheers,
Forever! We'll Fight-Fight-Fight!



MASCOT

A miner was chosen as the UNC Charlotte mascot as a nod to Reed Gold Mine in nearby Concord, the site of the first documented gold find in the United States in 1799. He was named Norm through popular student vote shortly after he was made mascot. Norm is rarely seen without his trusty pick-axe and never takes his slouch hat off.





The Graduate School

graduateschool.charlotte.edu
gradadmissions.charlotte.edu

The University of North Carolina at Charlotte was established in 1965 by the North Carolina General Assembly, which transformed Charlotte College, with beginnings in 1946, into a campus of The University of North Carolina. The Graduate School was established in 1985 with the appointment of the first Dean of the Graduate School, although graduate degree programs had been offered since 1969. Today, more than 800 members of the Graduate Faculty and over 6,300 graduate students participate in a broad array of graduate programs at the master's and doctoral levels and in graduate certificate programs.

The executive and administrative affairs of the Graduate School are carried out by the Associate Provost for Graduate Programs and Dean of the Graduate School, who acts in cooperation with the deans of the seven disciplinary colleges of Arts + Architecture, Business, Computing and Informatics, Education, Engineering, Health and Human Services, and Liberal Arts & Sciences.

Graduate Student Core Competencies

Unlike undergraduate education, graduate education is intended to develop independent, specialized skills and knowledge in a particular academic discipline. Graduate students completing a master's or doctoral degree should be able to claim competency in a range of skills, in addition to expertise in their academic discipline. The Graduate School has identified the following "core competencies" which graduate students should strive to develop. The ways in which these competencies are taught or interpreted will vary by program and will reflect the expectations of the specific degree program in which the student is enrolled. In addition, the Center for Graduate Life & Learning (CGLL) offers a variety of programs aligned with each competency.

- **Communication (Oral and Written):** Graduate students and postdocs at UNC Charlotte will develop the communication skills needed in order to write and speak effectively and persuasively using a variety of media. This includes preparing scholarly and peer reviewed publications, grant writing, public speaking, facilitating group discussions for various audiences, communicating effectively in the workplace, and increasing positive interpersonal relationships through communication.
- **Leadership:** Leadership skills are invaluable in academia and beyond. UNC Charlotte students and postdocs will have wide-ranging opportunities to develop the leadership competencies necessary to motivate, inspire, and manage others. The CGL and the Graduate School will promote the development of ethical, competent leaders, ensuring success in a variety of contexts. Mentorship, effective decision-making, problem solving, and management skills will be cultivated through graduate studies at UNC Charlotte.
- **Knowledge Development and Application:** Graduate students and postdocs will develop the critical thinking skills necessary to teach effectively in all types of environments: academic, corporate, or otherwise. They will possess an understanding of the challenges presented in non-traditional and inclusive settings, and they will master the skills needed to create dynamic learning in any environment. UNC Charlotte graduate teaching assistants will become competent with the most current instructional methods and technologies, enabling them to stimulate critical, innovative learning in others.
- **Diversity and Cultural Engagement:** Employers in today's highly connected and technological market seek employees who possess the necessary

intercultural fluency to work well in diverse teams. Now more than ever, graduate students and postdocs must continuously expand their understanding of, and appreciation for, the importance or diversity, equity, and inclusion in a variety of professional and academic settings. UNC Charlotte students will develop the particular skills set needed to create and advocate for inclusive and equitable environments.

- **Ethics and Scholarly Inquiry:** Graduate Students and postdocs at UNC Charlotte will develop the necessary scholarship skills for success in their chosen discipline, while maintaining a fierce commitment to ethical practices, both personally and professionally. These skills will reflect the commitment to diverse ideas, academic collegiality, and to continued student learning--concepts inherent to an interdisciplinary environment. Graduate students and postdocs at UNC Charlotte will be committed to lifelong learning and remain active in the search for knowledge.

Graduate Council

The Graduate Council, whose voting members are elected by the Graduate Faculty, reviews, develops, and makes recommendations concerning Graduate School policy. All curricular proposals and all criteria for membership on the Graduate Faculty come before the Graduate Council. In addition, the Graduate Council serves in an advisory capacity to the Dean of the Graduate School.

Graduate Faculty

In accordance with criteria developed by each graduate program or unit and approved by the Graduate Council, the Dean of the Graduate School appoints members of the Graduate Faculty for renewable terms. Members of the Graduate Faculty offer courses and seminars, mentor graduate students, and supervise research at an advanced level of scholarship.

Graduate Program Directors

Each graduate program, and in some cases certain program areas within a discipline, has a Graduate Program Director. This individual is a member of the Graduate Faculty and is responsible for coordinating and managing various functions of the graduate program, including recruitment, admissions, funding, enrollment, and retention to graduation. Directors, along with a student's advisor, assist students with understanding program requirements and can answer program specific questions such as transfer credit, prerequisites, program specific admission requirements, etc.

TYPES OF GRADUATE PROGRAMS

This section generally describes types of degrees and programs. See the "Academic Programs" section of this *Catalog* for a list of specific available graduate programs.

Doctoral and Master's Degree Programs

UNC Charlotte offers 24 doctoral and 65 master's degree programs. To be admitted to a degree program, an applicant must meet all the requirements for admission, be recommended for admission by the program in which they propose to study, and receive final approval for admission by the Graduate School. Acceptance into one graduate program does not guarantee acceptance into another one.

Graduate Certificate Programs

UNC Charlotte offers 50 graduate certificate programs and 8 post-master's certificate programs. Graduate certificate programs (including post-master's certificate programs) are designed for students who wish to complete a coherent program in a defined area to enhance their professional skills and/or academic knowledge. Most graduate certificate programs do not require a standardized test to apply for admission, thereby enabling prospective students to begin graduate study fairly quickly.

Students are admitted to a specific graduate certificate program and advised by faculty in the unit offering the graduate certificate. Many of UNC Charlotte's graduate certificate programs are comprised of the courses in a master's degree. Since the graduate certificate is not a degree, students may apply the credits earned in the certificate program toward a single (master's or doctoral) degree that they pursue either concomitant with pursuing a graduate certificate or after the certificate has been awarded. *[Please note: time to degree limits do apply.]*

Post-Baccalaureate (Non-Degree) Program

Applicants seeking to take courses beyond the baccalaureate degree for license renewal, for transfer to another institution, as prerequisites for admission to a graduate degree program, or for personal satisfaction may be admitted as post-baccalaureate/non-degree students. The number of transfer credits that may apply to a degree program can vary. Post-baccalaureate students must apply for admission each semester. See "Registration, Transfer Credit" under the Degree Requirements and Academic Policies section of this *Catalog* for details.

Readmission – All Students

Graduate certificate and degree-seeking students whose enrollment is interrupted will remain eligible to register for one semester without having to reapply for admission to the University if they are in good standing and have not exceeded the five-, seven-, or nine-year limit for their academic program of study. After an absence of more than two consecutive academic semesters (Fall, Spring), the student's record will be closed and the student must apply for readmission; acceptance is subject to program and Graduate School approval. Students whose enrollment is suspended or terminated for academic reasons should consult the description of the procedures outlined in the "Academic Standing" section of the *Catalog*. Students whose enrollment is suspended or terminated for disciplinary reasons must have their readmission materials reviewed by the Campus Safety Review Committee; see the UNC Charlotte Code of Student Responsibility within this *Catalog*.

Accelerated Master's Programs

See "Registration" under the Degree Requirements and Academic Policies section of this Catalog for details.

Dual Undergraduate and Graduate Registration

See "Registration" under the Degree Requirements and Academic Policies section of this Catalog for details.

Early Entry to Graduate Programs

See "Registration" under the Degree Requirements and Academic Policies section of this Catalog for details.

GRADUATE STUDENT LIFE

Center for Graduate Life & Learning

The Graduate School is committed to providing graduate students at UNC Charlotte with the highest caliber of graduate education. While academic instruction and scholarly research are the ultimate foundation of any graduate education, the Graduate School also recognizes the importance of providing students with the resources and services needed to develop themselves professionally. The Graduate School's Center for Graduate Life & Learning (CGLL) supports the success of all graduate students. Located in Atkins Library, the CGLL offers space for community building and interdisciplinary exchange. The center offers professional development in the form of credit-bearing courses and workshops to build core competencies among students in communication, leadership, teaching, cultural engagement, and ethics and scholarly inquiry.

Doctoral Writing Support

The Center for Graduate Life & Learning supports the writing efforts of master's students and doctoral students who are actively writing their dissertations. The CGLL's Assistant Teaching Professor of Writing offers one-on-one coaching sessions to help dissertation students improve their academic writing skills, understand the dissertation process, work more effectively with their chairs and committee members, manage their time, set realistic writing goals, and deal with barriers to writing. Graduate students are encouraged to participate structured communal writing time held regularly and in Graduate Writing Retreats offered several times each academic year.

Graduate Life Fellows

Each year, the Center for Graduate Life & Learning appoints a group of master's and doctoral-level students from across degree disciplines to serve as Graduate Life Fellows (GLFs). GLFs enjoy the opportunity to gain important leadership and communication skills while having a meaningful impact on the graduate student experience. For more information on the GLF program, visit gradlife.charlotte.edu/about-us/graduate-advocates.

New Graduate Student Orientation

The Graduate School conducts University-wide orientation programs for new graduate and post-baccalaureate students at the start of each Fall, Spring, and Summer semester. Information about the dates and times of these programs can be found online at gradlife.charlotte.edu/graduate-community/orientation. Information is also sent directly to newly enrolled students at the time of matriculation, along with the link to the Graduate School's New Graduate Student Onboarding Portal at sites.google.com/uncc.edu/uncc-grad-student-portal/home.

The New Graduate Student Onboarding Portal is a curated guide that offers a snapshot of vital information new graduate students need from the time they enroll through their first year. In addition to providing the basics that students need to get started, the site highlights information about various University programs and services for graduate students, important policies and procedures, and resources available to support graduate students academically and socially.

Many individual graduate programs conduct discipline-specific orientation programs for their new graduate students. Degree students should contact their major department for information on programs that may be available. In addition, the International Student/Scholar Office (ISSO) conducts orientation sessions specifically designed for international graduate students.

Graduate Teaching Assistant Training

In an effort to ensure all Graduate Teaching Assistants (GTA) have the necessary information and policies needed to be successful in their teaching role, the Center for Graduate Life & Learning requires each new GTA to complete online training prior to the start of their assistantship. This training, available in Canvas, includes modules on FERPA, Discrimination/ADA, Common First Amendment Issues, Title IX, Classroom Management, The Art of the Rubric, and more. The online training is required by UNC Charlotte, in addition to any TA Training offered at the department level. More information can be found online at gradlife.charlotte.edu/professional-development/teaching-skills.

Student Involvement

Students at UNC Charlotte are encouraged to participate in co-curricular activities. UNC Charlotte acknowledges that graduate students have many, many priorities in their lives. However, as with so many other aspects of one's life, active involvement enhances the experience, promotes well-being, and helps individuals develop skills needed for professional success.

Graduate students are encouraged to participate in student leadership at some point during their academic career. In particular, graduate students may hone skills that will be useful in a variety of academic and industry professions. An active student body contributes to the vibrant community of graduate students and scholars at UNC Charlotte, making graduate education more relevant to students across disciplines.

Graduate and Professional Student Government

The Graduate and Professional Student Government (GPSG) is the governing and primary organization for graduate students to present their needs to the University. The purpose of the Graduate and Professional Student Government (GPSG), according to the by-laws, is to serve as an appropriate voice on campus for graduate students, to meet the various needs of graduate students, and to establish a liaison between graduate faculty, graduate students, and the University. All graduate students are members of the GPSG.

In the spring of 1998, the Graduate Student Association successfully petitioned the student body through a referendum on the spring student body elections. The results of this referendum provided a significant change in the student body constitution and provided for the Graduate and Professional Student Government to become a separate governing body and representative organization for graduate students. In outlining the reasons for this separation, the GPSG cited the need for a GPSG office and the graduate student share of student activity fees to support: departmental graduate student associations, graduate student travel to read papers and present research at academic conferences, and developing a Graduate Student Research Fair.

During the 1998-1999 academic year, GPSG began functioning as its own governing body. In the 1999-2000 academic year, the recognition of current (and new) graduate student organizations and the funding of these groups, including the GPSG, became the responsibility of the Graduate and Professional Student Government. In 2019, GPSG formally separated from SGA to become its own separate organization. Since the inception of the GPSG, the availability of student activity fees to graduate students directly have increased dramatically. GPSG has been very successful in advocating for and supporting graduate student needs. An annual Research Symposium competition was begun in the spring of 2001 to showcase and reward excellence in graduate student research across all disciplines. GPSG continues to be active in new graduate student orientation, encouraging and recognizing graduate student organizations and increasing the amount of student activity fee support for graduate students. Each graduate program has the opportunity to be represented on the GPSG senate.

The GPSG Office is located in the Student Union. More information can be found online at gpsg.charlotte.edu.

Graduate Student Organizations

There are a number of graduate student organizations directly associated with academic programs. These include:

- Advocates for Change (AFC)
- American Society for Computational Mechanics (ASCM)
- American Society for Precision Engineering (ASPE)
- Anthropology Graduate Student Association (AGSA)
- Association of Biological Sciences Graduate Students (ABSGS)
- Association of Chemistry Graduate Students (ACGS)
- Association of Nanoscience Graduate Students (ANGS)
- Bioinformatics Assembly of Students (BiAS)
- Biology Graduate Outreach
- CCI Grads (CCI Grads)
- Charlotte Healthcare Executive Student Organization (CHESO)
- Children's Literature Graduate Organization (CLGO)
- Club for A.I. Research (CAIR)
- Communication Studies Graduate Student Association (CSGSA)
- Ekush-Bangladeshi Student Organization at UNC Charlotte (EKUSH)
- English Graduate Student Association (EGSA)
- Geography and Earth Science Graduate Organization (GESGO)

- Gerald G. Fox GFOA Student Chapter
- Giftedness, Creativity, Innovation, and Talent Research (G-CITE)
- Graduate and Professional Student Government (GPSG)
- Graduate Business Association (GBA)
- Graduate History Association (GHA)
- Graduate Public Health Association (GPHA)
- Graduate Public Policy Association (GPPA)
- Graduate Social Work Association (GSWA)
- Health Psychology Graduate Student Association (HPGSA)
- LGBTQ+ Graduate Coalition
- Master of Architecture Student Society (MASS)
- Mathematics Graduate Student Association
- Mu Tau Beta (Counseling) (MTB)
- Philosophical Union UNCC (Philosophical Union)
- Public Administration Student Association (PASA)_
- School of Data Science Student Organization (SDS SO)
- Sociology Graduate Student Association (SGSA)
- SPIE/OSA Student Chapter at UNC Charlotte (SPIE)
- Urban Educators for Change (UEC)

Information on each group is available from the individual academic program department. Some groups have information available on the Student Organizations website at ninerengage.uncc.edu/organizations?categories=9859.

ADMISSION TO THE GRADUATE SCHOOL

Admissions Information

It is the policy of the University that educational decisions are based on relevant and appropriate factors and cannot be based on an individual's protected status, whether that status is protected by law or by University policy. As a result, admissions decisions are based on a holistic review of an individual's abilities and qualifications, including academic history, professional experience related to the educational program, recommendations provided by individuals who can reference an applicant's potential for success, and skills necessary for achievement in a particular discipline. The intent of the Graduate School is to offer admission to those applicants whose credentials indicate a strong likelihood of success in their selected curricula.

The University reserves the right to withhold or rescind the admission and enrollment of a person who: (1) fails to meet any of the requirements for admission at the time of matriculation, (2) fails to maintain satisfactory academic performance in their course of study prior to enrollment, or (3) provides incorrect or misleading information on the application for admission or supporting document set. Additionally, meeting the minimum admission requirements does not guarantee admission to a graduate program and the University reserves the right to restrict enrollments when necessary because of budgetary, and/or other capacity constraints.

Application Materials

A separate application, processing fee, statement of purpose, recommendations, and transcripts must be submitted for **each** graduate program of study for which a student applies for admission. Questions about the application process should be directed to:

Graduate Admissions
UNC Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001
Telephone: 704-687-5503
Fax: 704-687-1668
E-mail: gradcounselor@uncc.edu
Web: gradadmissions.charlotte.edu

Application Deadlines

Prospective students are encouraged to apply and submit all supporting documents well in advance of a program's published deadlines. ***Many programs have earlier deadlines than the Graduate School's priority and final deadlines and may only admit students to a particular semester or term.*** Prospective students should view information on the academic program website for the most up-to-date details regarding application requirements, admission, and funding. The Graduate School may alter the date for acceptance of applications without further notice in accordance with available resources and/or the enrollment limitation established by the North Carolina General Assembly or the University. Note that applications received or applications that become complete after a program's deadlines or the Graduate School's priority deadlines are processed on a space-available basis or they may be withdrawn from consideration.

Term of Entry	Application and Supporting Documents Priority Submission Deadline	Final Application Deadline
Fall	March 1	August 1
Spring	October 1	January 1
Summer*	April 1	June 15

** There are a variety of sessions that begin with a Fall, Spring or Summer term, beginning and ending on different*

dates; however, deadlines to register may vary. For the Summer term, June 15 is the last day an application for admission can be submitted, but this date is for classes that begin in July.

Note: International students who intend to enroll on an F-1 or J-1 visa status should apply for admission before the priority deadlines, if possible.

Application Processing
Applicants apply for admission online; instructions and the application are available at gradadmissions.charlotte.edu. Applications of U.S. Citizens, U.S. Permanent Residents, Asylees, and Refugees are processed as "domestic" applications. Applications of students on or who intend to be on temporary visa/status in the U.S. (i.e., F-1, H-1, H-4, etc.), as well as Pending Permanent Residents, are processed as "international" applications.

Application Processing Fee
Submission of the online application for admission to graduate study requires online payment of the U.S. application fee by credit card. Note that the application fee may change and the amount required is accurately reflected in the application instructions available online. The fee is waived or refunded for certain full-time employed University employees (lifetime limit of six waivers per person) and McNair Scholars; otherwise, the processing fee is required and nonrefundable. Fraudulent use of a credit card to pay the University's application fee will result in reconsideration of the admissions application and may result in revocation of any offer of admission.

Application Status
Applicants will receive an online confirmation of successful submission of their application for admission to graduate study, and can monitor the status of the application in their applicant portal.

Types of Admission
(For Doctoral Degrees, Master's Degrees, and Graduate Certificates)

Full Standing
Applicants who meet the general requirements for admission to graduate study, plus any additional requirements specified by the program, may be offered admission.

Applicants offered admission to graduate programs who have not yet completed their undergraduate degree and/or who were admitted with unofficial transcripts will be allowed to register for one semester and can only continue after the Graduate School's receipt of official final transcripts (and/or the diploma/degree certificates/mark sheets) indicating the award of the baccalaureate (bachelor's/undergraduate) degree from an institution accredited by an accepted accrediting body* or its equivalent. Students will have a maximum of one semester to enroll, after which time a hold will be placed on their accounts to prevent registration for future terms. Failure to submit the proper credentials during the first semester of enrollment will result in a hold on registration for subsequent terms.

** Accepted Accrediting Body: the following are accepted accrediting bodies: Accrediting Commission for Community and Junior Colleges (ACCJC) Western Association of Schools and Colleges, Higher Learning Commission (HLC), Middle States Commission on Higher Education (MSCHE), New England Commission of Higher Education (NECHE), Northwest Commission on Colleges and Universities (NWCCU), Southern Association of Colleges and Schools Commission on Colleges (SACSCOC), and WASC Senior College and University Commission (WSCUC).*

Deferment Policy
The Office of Graduate Admissions does not defer applicants offered admission. Individuals admitted to a graduate program of study who fail to enroll for the term to which they have been admitted are presumed to have withdrawn their application. To be considered for admission to a different term, year, or program, individuals must submit a new application and supporting materials. Generally, official test scores, transcripts, and recommendations are maintained on file in the Graduate School for one year.

Policy on Updating Applications
Applicants who do not submit their supporting documentation in time to be considered for admission to the requested term must submit a new application which includes updated data, the processing fee, statement of purpose, recommendations, transcripts, and any additional information required by the program. Generally, official test scores, transcripts, and recommendations are maintained on file in the Graduate School for one year.

Students whose admission to UNC Charlotte was denied must submit a new application, fee, and supporting documents/materials to be considered for admission to a different semester/term or program.

General Application Requirements for Admission

Doctoral Degree Programs
To be considered for admission to a doctoral program, an applicant must have a bachelor's degree (or its U.S.

equivalent) from a college or university that is accredited by an accepted accrediting body. Some programs admit baccalaureate (bachelor's degree) students directly to the doctoral program, while others require applicants to have earned a master's degree.

To be admitted to a doctoral program after a master's program, an applicant should have earned an overall grade point average of at least 3.5 (on a 4.0 scale) in the master's degree program. To be admitted to a doctoral program after a bachelor's program, an applicant should have earned an overall GPA of at least 3.0 in the bachelor's degree program. Individual programs may have additional application/admission requirements as specified in program descriptions in this *Graduate Catalog* and/or the program's websites. Applicants must also be in good academic standing at the last institution of higher education attended; otherwise, the individual must not have been enrolled for two years prior to being considered for admission to a graduate program at UNC Charlotte.

Master's Degree Programs

The applicant must possess at least a bachelor's degree, or its U.S. equivalent, from a college or university accredited by an accepted accrediting body, and must have attained an overall grade point average of at least 3.0 (based on a 4.0 scale) on all of the applicant's previous work beyond high school. If an applicant has earned or attempted a post-baccalaureate degree (i.e., a master's, doctoral, or other), grades in that program will also be taken into consideration. Individual programs may have additional application/admission requirements as specified in program descriptions in this *Graduate Catalog* and/or the program's website. Applicants must also be in good academic standing at the last institution of higher education attended; otherwise, the individual must not have been enrolled for two years prior to being considered for admission to a graduate program at UNC Charlotte.

Graduate Certificate Programs

The applicant must possess at least a bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body, and must have attained an overall grade point average of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school). If the applicant has earned or attempted a post-baccalaureate degree (i.e., master's, doctoral, or other), grades in that program will also be taken into consideration. Individual programs may have additional application/admission requirements as specified in program descriptions in this *Graduate Catalog* and/or the program's website. Applicants must also be in good academic standing at the last institution of higher education attended; otherwise, the individual must not have been enrolled for two years prior to being considered for admission to a graduate program at UNC Charlotte.

Applications generally consist of the items listed below. Any materials submitted in support of an application for admission to graduate study become the property of the University and cannot be returned to the applicant.

1) The **application form** must be submitted online through the Graduate School's application system. The online application system can be accessed via gradadmissions.charlotte.edu. Submission of the application form requires payment of an application fee, which is paid online by credit card; the fee is neither deductible nor refundable.

2) A **Statement of Purpose** (personal essay) must be submitted online as part of the application submission process. The Statement of Purpose describes the applicant's experience, objectives for undertaking graduate study and research interests, if known. [Note: Some graduate programs request specific items to be included in the Statement of Purpose. Applicants should check the department's website or contact the department directly for further clarification on specific requirements related to the Statement of Purpose.]

3) **Transcripts** of all academic work attempted beyond high (secondary) school are required of all students offered admission who enroll at UNC Charlotte. For the application and admission processes, current/unofficial transcripts of each academic institution of higher education ever attended must be submitted (and must be uploaded directly to the online application); transfer credit posted on the records of other institutions is unacceptable and transcripts of these credits must be supplied. Applicants who have taken early college credits during high school must provide transcripts showing college credit. International transcripts must be issued in English by the institution or be accompanied by an English translation by an official, certified translation company.

4) If required by the program, **one to three recommendations** from persons familiar with the applicant's academic and/or professional qualifications should be submitted. Note that many graduate certificate programs do not require recommendations. If required, the recommendation forms must be submitted via the online application system; letters of reference in support of an individual's admission may also be uploaded directly to the online recommendation form. Recommendations or letters sent to the Graduate School in any other format,

including surface mail and email, may not be processed or considered as part of the application file.

5) If required by the program, official agency reports of **satisfactory test scores** as specified in the section on graduate programs in this Catalog. GRE/GMAT scores are reportable from ETS for a period of five years from the date of the exam. Likewise, the Graduate School accepts GRE/GMAT scores which are up to five years old as part of the application process. GRE/GMAT scores older than five years are therefore not acceptable since they cannot be officially reported. Likewise, MAT scores more than five years old are not accepted. MCAT, LSAT, and PAEP scores are accepted by some graduate programs and should be no older than five years. For additional information regarding test score requirements, please see the "Test Information" section of this *Catalog*.

6) **Official scores** on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution. The Graduate School requires either a minimum score of 83 on the Internet-based TOEFL, a minimum score of 557 on the paper-based TOEFL, or a minimum overall band score of 6.5 on the IELTS. Some graduate programs require higher scores.

Notes:

1) *Applicants with records of high quality who do not fulfill these requirements should discuss with the Graduate Program Director other factors that may have a bearing on admission. Some programs have higher standards or additional admission requirements. Additionally, there may be prerequisites for certain programs and applicants should consult the Graduate Program Director to identify prerequisites. A separate application for admission is required for each graduate, post-baccalaureate, and certificate program of study at UNC Charlotte.*
2) *All applicants submitting transcripts and degree certificates from non-U.S. educational institutions should note that bachelor's degrees awarded by non-U.S. schools may or may not be considered equivalent to the U.S. bachelor's degree. Recipients of degrees that are not at least equivalent to a U.S. bachelor's degree may not be eligible for graduate study at UNC Charlotte.*
3) *International Students should see the "Additional Admission Requirements for all International Applicants" section of this* Catalog *for additional requirements.*

Post-Baccalaureate (Non-Degree) Program

The applicant must possess a bachelor's degree, or its U.S. equivalent, from a college or university accredited by an accepted accrediting body. UNC Charlotte students having less than 12 credit hours to complete their first undergraduate degree may be allowed to enroll as a post-baccalaureate (non-degree) student; see "Dual Undergraduate and Graduate Registration" in the Degree Requirements and Academic Policies section. Applicants must also be in good academic standing at the last institution of higher education attended; otherwise, the individual must not have been enrolled for two years prior to being considered for admission to a graduate program at UNC Charlotte.

Applications generally consist of the items listed below and should be submitted online. Application materials submitted in support of an application for admission to graduate study, including non-degree study, become the property of the University and cannot be returned to the applicant.

1) The **application form** must be submitted online through the Graduate School's application system. The online application system can be accessed via gradadmissions.charlotte.edu. Submission of the application requires payment of an application fee, which is paid online by credit card; the fee is neither deductible nor refundable.

2) **Official scores** on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution. Required is either a minimum score of 83 on the Internet-based TOEFL, a minimum score of 557 on the paper-based TOEFL, or a minimum overall band score of 6.5 on the IELTS.

Notes:

1) *A separate application for admission is required for each graduate-level program of study, whether post-baccalaureate (non-degree), certificate, master's, or doctoral programs. A post-baccalaureate (non-degree) student who subsequently applies and is admitted to a graduate degree program may, with the permission of their advisor and the Graduate School, apply a maximum of six credit hours completed in the post-baccalaureate (non-degree) status toward a graduate degree or certificate program.*
2) *International Students should see the "Additional Admission Requirements for all International Applicants" section of this Catalog for additional requirements.*

Additional Admission Requirements for all International Applicants and/or Applicants Whose Native Language is Not English

The following items must be submitted as part of the application process and are required before an admission decision can be rendered.

1) **Official scores** on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution. Required is either a minimum score of 83 on the Internet-based TOEFL, a minimum score of 557 on the paper-based TOEFL, or a minimum overall band score of 6.5 on the IELTS.

Additional Enrollment Requirements for International Applicants on, or Intending to be on, F-1 or J-1 Visa Status

Upon admission, students will be asked to confirm their enrollment. Additionally, the International Student Scholar Office will request students to complete an online Financial Certificate Form and upload financial documents. The International Student and Scholar Office is responsible for issuing I-20s and DS-2019s.

Test Information

Applicants to programs that require submission of test scores should have their official test scores sent directly from the testing agency to the Office of Graduate Admissions (not to the department in which they wish to study). For the GRE-and TOEFL, UNC Charlotte's institution code is 5105. For the MAT, UNC Charlotte's institution code is 1370. For the GMAT, please visit gradadmissions.charlotte.edu/apply-now/application-requirements/test-scores to determine the code of the program to which you plan to apply for admission.

Some graduate programs have specific test waivers for applicants to their programs; check the Graduate Catalog for details regarding program-specific waiver criteria and/or communicate directly with the Graduate Program Director.

Graduate Record Examination (GRE)

The GRE is administered by Educational Testing Service (ETS). To obtain information about and schedule a test for the GRE, please visit the GRE website at gre.org. UNC Charlotte's school code is 5105.

Miller Analogies Test (MAT)

Harcourt Assessment, Inc administers the MAT. For additional information on the MAT, please visit milleranalogies.com. To register for the test at UNC Charlotte, please visit caps.charlotte.edu/counseling-and-consultation-services/miller-analogies-test or call 704-687-0311. To register in another city or for more information, visit milleranalogies.com or call 1-800-622-3231.

Graduate Management Admission Test (GMAT)

The GMAT is sponsored, owned, and directed by the Graduate Management Admission Council (GMAC) and is administered by Pearson VUE. Visit the GMAC website at mba.com for additional information and to register for the GMAT. The GMAT Customer Service Telephone in the Americas is 1-800-717-GMAT (4628). See the Graduate Admissions website at gradadmissions.charlotte.edu/apply-now/application-requirements/test-scores for the school codes.

Test of English as a Foreign Language (TOEFL)

The TOEFL is administered by Educational Testing Service (ETS). To obtain additional information about the TOEFL or to register for the TOEFL online, please visit the TOEFL website at toefl.org.

International English Language Testing System (IELTS)

The IELTS assesses the complete range of English language skills which students studying in English commonly encounter. For further information, visit ielts.org.

Appeal Procedure for Applicants Denied Admission

Applicants denied admission may appeal the decision but only on the grounds that the denial was based on a violation of Section II of the University's Admissions Policy. Essentially, the policy maintains that if an applicant is denied admission to the Graduate School, they may appeal the decision based solely on the grounds that the denial violates University admissions policy not to discriminate in offering access to its educational programs and activities on the basis of age, gender, race, color, national origin, religion, creed, disability, veteran's status, sexual orientation, gender identity, or gender expression.

The appeal must be in writing, must set forth with specificity the grounds for the appeal, and must be directed and delivered to the Dean of the Graduate School. Upon receipt of the appeal, the Dean will review the applicant-appellant's file and appeal letter and will communicate their decision to the applicant-appellant in writing within thirty (30) calendar days of receipt of the appeal. Appeals must be received prior to the term for which the applicant is seeking admission. If there is insufficient time to complete the appeal process before the beginning of the term for which the applicant seeks admission, the Dean of the Graduate School may decline to review the appeal. For more information, see Appendix A to University Policy 207 online at legal.charlotte.edu/policies/up-207/appendix-a.

Health Requirements

Health Insurance Requirements

Health insurance is required of all degree-seeking undergraduate students with six or more on-campus credit hours; all degree- or certificate-seeking graduate students with three or more on-campus credit hours; and all international students with an F-1 or J-1 visa, regardless of credit hours.

Students who are currently uninsured may enroll in the Student Health Insurance Plan by completing the enrollment form found on the Student Health Center website at studenthealth.charlotte.edu. Pricing is available on the site as well.

Students with existing health insurance coverage must supply this information online to the Student Health Center every Fall and Spring semester by the posted due date. See the Student Health Center website above for details. Failure to comply will result in automatic enrollment in the Student Health Insurance Plan for the semester.

Immunization Requirements

To protect all students at UNC Charlotte, North Carolina state law requires proof of immunizations upon entering the University. Under North Carolina regulations, students not in compliance will be dropped from all courses. **Upon learning of admission to the University, students should submit their immunization records immediately.** Immunization Records must be uploaded via the Online Student Health Portal. Further details regarding the immunization requirements and the records submission process are available online from the Student Health Center at studenthealth.charlotte.edu. Please consult the website for more detail about the requirements before submitting records to the University. Although a health physical is not required for admission to the University, students are strongly encouraged to contact their healthcare provider or local health department to discuss additional recommendations for vaccinations.

COLLEGE/UNIVERSITY VACCINES AND NUMBER OF DOSES REQUIRED	
Vaccines Required	**Dosage**
Tetanus, Diphtheria, Acellular Pertussis (Tdap)[1]	1
Diphtheria, Tetanus, and/or Pertussis[1]	2
Polio[2]	3
Measles[3]	2
Mumps[4]	2
Rubella[5]	1
Hepatitis B[6]	3
Varicella[7]	1

FOOTNOTE [1] – Three doses of tetanus/diphtheria toxoid, of which one must be tetanus/diphtheria/pertussis (Tdap). Students enrolling in a 4-year college or university for the first time on or after July 1, 2008, must receive a tetanus/diphtheria/Pertussis (Tdap) vaccine.

FOOTNOTE [2] – An individual attending school who has attained his or her 18th birthday is not required to receive polio vaccine.

FOOTNOTE [3] – Measles vaccines are not required if any of the following occur: Diagnoses of disease prior to January 1, 1994; An individual who has been documented by serological testing to have a protective antibody titer against measles and submits the lab report; or An individual born prior to 1957. An individual who enrolled in college or university for the first time before July 1, 1994, is not required to have a second dose of measles vaccine.

FOOTNOTE [4] – Mumps vaccine is not required if any of the following occur: An individual who has been documented by serological testing to have a protective antibody titer against mumps and submits the lab report; An individual born prior to 1957; or Enrolled in college or university for the first time before July 1, 1994. An individual entering college or university prior to July 1, 2008, is not required to receive a second dose of mumps vaccine.

FOOTNOTE [5] – Rubella vaccine is not required if any of the following occur: 50 years of age or older; Enrolled in college or university before February 1, 1989 and after their 30th birthday; An individual who has been documented by serological testing to have a protective antibody titer against rubella and submits the lab report.

FOOTNOTE [6] – Hepatitis B vaccine is not required if any of the following occur: Born before July 1, 1994. Serological testing to document protective antibody titer against Hepatitis B is not acceptable.

FOOTNOTE [7] – Varicella vaccine is not required if any of the following occur: Documented physician diagnosis of disease, a student has been documented by serological testing to have a protective antibody titer against varicella and submits the lab report; or a student is born before April 1, 2001.

International Students

Vaccines are required as noted above. Additionally, International students are required to have a TB skin test and negative result within the 12 months preceding the first day of classes (chest x-ray required if test is positive). A TB blood test (T-spot, QuantiFERON Gold Plus) is also

accepted.

Freshman and Transfer Students

Immunization records are not sent with other admission records from your previous school. You must request your immunization records be sent directly to the Student Health Center.

Immunization Policy Reinstatements

At least 21 days prior to the start of classes, students who are not in compliance will receive a communication from the Student Health Center (SHC) with details on how to comply with state law. Students who remain in noncompliance as determined by the SHC will be withdrawn from all applicable courses by the Office of the Registrar at the end of the thirty (30) day period. Students are therefore strongly encouraged to submit their immunization records prior to the start of the semester. The SHC will also monitor students who are not in compliance but have been approved by the SHC for an extension to receive the necessary immunizations as indicated by a physician's letter. Once the date for the extension expires, and if the student is still not in compliance, the SHC will notify the Office of the Registrar that the student has failed to comply with Immunization Requirements. The Office of the Registrar will then withdraw the student from all applicable courses.

Students will be reinstated to their courses after providing evidence of compliance with immunization requirements to the SHC before the end of the last class day of the semester. This reinstatement pertains only to student enrollment status and does not in any way guarantee that the academic, financial, and/or other consequences of noncompliance with immunization requirements can or will be remedied. Such consequences may include, but are not limited to, impact on immigration status, financial aid eligibility, University housing, and University accounts. Additionally, reinstated students may not be eligible to make up class work, assignments, tests, or exams as faculty are encouraged but are not obligated to allow make-up work as appropriate.

Decisions under this policy cannot be appealed, and students will not be reinstated if they become compliant with immunization policies after the last class day of the semester.

Contact Information

Questions regarding these mandatory requirements may be directed to the Student Health Center Immunizations Department at 704-687-7424 or immuinfo@charlotte.edu.

WORKPLACE COMPETENCIES

- Graduate Certificate in Workplace Competencies

The Center for Graduate Life and Learning

gradlife.charlotte.edu

Graduate Certificate in Workplace Competencies

The Graduate Certificate in Workplace Competencies responds to specific documented needs of employers for employees with graduate and professional degrees who are also well-versed in basic workplace competencies such as written and verbal communication, presentation-building, managing new initiatives, and personnel management. It is designed for graduate students across all disciplines, those with recently minted undergraduate degrees who wish to bolster their job market prospects, and young professionals in the local Charlotte business community who wish to enhance their career prospects.

Admission Requirements

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- A cumulative GPA of 2.75 (out of a 4-point scale) for all work completed beyond high school
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college coursework attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Certificate Requirements

This certificate program requires the completion of 12 credit hours. All requirements must be completed within four years.

Core Courses (6 credit hours)

GRAD 6304 - Intrapreneurship for Non-Business Majors - The Practice of Internal Entrepreneurs (2)

GRAD 6320 - Personal Career Branding: Identity, Management, and Promotion (2)
GRAD 6340 - Data Analysis and Presentation for Impact (2)

Elective Courses (6 credit hours)
Select from the following:

ENGL 6116 - Technical/Professional Writing (3)
GRAD 6330 - Workplace Communications (2)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6165 - Negotiation and Conflict Management (3)
MBAD 6279 - Design Thinking and Innovation (3)

Note: Requests for course substitutions may be approved by Graduate Program Director.

Grade Requirements

Students must earn a minimum cumulative GPA of 3.0.

Certificate Total = 12 Credit Hours

University Regulation of Student Conduct

As students willingly accept the benefits of membership in the UNC Charlotte community, they also commit to obligations to observe and uphold the principles and standards of conduct that reflect the values of the UNC Charlotte community.

At UNC Charlotte, *University Policy 406, The Code of Student Responsibility*, fulfills the duty of the Chancellor to regulate matters of student conduct in the University community. *University Policy 407, The Code of Student Academic Integrity*, governs student behavior relating to academic work. All UNC Charlotte students are expected to be familiar with both Codes and to conduct themselves in accordance with these requirements. Any person may report an alleged violation(s) of the Code online at incidentreport.charlotte.edu. Individuals may report crimes or incidents involving imminent threat of harm to Police and Public Safety at 704-687-2200.

The University has also established a program for the prevention of the use of illegal drugs and alcohol abuse (University Policy 711), as well as a policy regulating smoking and tobacco product use on campus (University Policy 707). All UNC Charlotte students are obligated to be familiar with and to conduct themselves in accordance with the standards set forth in these policies.

Additionally, the Student Government Association has created a code called *The Noble Niner* that solidifies the high standard of morals, principles, and integrity that all students should strive to uphold the reputation of excellence at UNC Charlotte.

THE CODE OF STUDENT ACADEMIC INTEGRITY

legal.charlotte.edu/policies/up-407

The Code of Student Academic Integrity governs the responsibility of students to maintain integrity in academic work, defines violations of the standards, describes procedures for handling alleged violations of the standards, and lists applicable penalties. Except in cases of Research Misconduct, as set forth in Chapter 3, Section III.3 of the Code, the following conduct, or complicity in the following conduct, is considered Academic Misconduct under the Code:

A) **Cheating** using or attempting to use materials, or giving assistance or materials without Authorization to another in any academic exercise that could result in gaining or helping another to gain academic advantage. Cheating includes, but is not limited, to the following actions:
   1) Copying - copying from another's assignment, examination, or other academic exercise;
   2) Use of Unauthorized Materials - using materials or equipment in connection with an assignment, examination, or other academic exercise which have not been authorized by the faculty member,

including but not limited to, notes, calculator, websites, or other technology;

3) Misrepresentation - permitting another to substitute for one's self in an academic exercise, or submitting of an academic exercise that has been prepared by another;
4) Unauthorized Collaboration - sharing the work or effort in an academic exercise with another individual or individuals without Authorization. See examples.

B) **Fabrication** means providing fabricated information, including inventing or counterfeiting information, in any form in an academic exercise. See examples.
C) **Falsification** means altering without Authorization any data or information, regardless of communication method (e.g., e-mail or other electronic communication), in an academic exercise. See examples.
D) **Misuse of Academic Materials** means sharing, distributing, altering, acquiring, damaging, or making inaccessible academic materials without Authorization, that could result in gaining or helping another to gain an academic advantage. See examples.
E) **Multiple Submission** means submitting academic work or substantial portions of the same academic work (including oral reports) in more than one academic exercise without Authorization. See examples.
F) **Plagiarism** means presenting the words or ideas of another as one's own words or ideas, including failing to properly acknowledge a source, unless the ideas or information are common knowledge. Plagiarism includes self-plagiarism, which is the use of one's own previous work in another context without indicating that it was used previously. See examples.
G) **Research Misconduct** means a determination that Research Misconduct has occurred under University Policy 309, Responding to Allegations of Misconduct in Research and Scholarship and its Supplemental Procedures. (See Chapter 3, Section III of the Code.)

A full explanation of these definitions, and a description of procedures used in cases where student violations are alleged, is found in the complete text of University Policy 407, The Code of Student Academic Integrity, as it may be modified from time to time. Students are advised to contact the Dean of Students Office or visit legal.charlotte.edu/policies/up-407 to ensure they consult the most recent edition.

THE CODE OF STUDENT RESPONSIBILITY

legal.charlotte.edu/policies/up-406

Philosophy and Purpose

The purpose of the Code is to uphold academic and community standards; encourage personal accountability and responsible decision making; promote student learning; and reduce and prevent behavior that undermines student success and community safety.

The University is committed to providing a fair, impartial, and efficient process facilitated through compassionate conversations in which students are heard, respected, and treated with dignity. All students are responsible for conducting themselves in a manner that helps enhance an environment of learning in which the rights, dignity, value, and freedom of each member of the academic community are respected.

The University works to create and sustain an environment where freedom of speech and expression are supported and honored. The University has the discretion to regulate the time, place, and manner of exercising these and other Constitutionally protected rights. In administering this Code, the University will exercise care to preserve the freedom of speech and expression for all in the campus community.

As with the scales of justice, the University's work in the area of student conduct is about balance. The University must balance students' free speech rights with the desire to protect the Campus community from discriminatory words and actions. The University acknowledges that higher education student conduct and disciplinary systems have, historically, contributed to systemic racism. Therefore, the University must balance its commitment to preserving student rights, encouraging responsible growth and development of its students, protecting the rights of those targeted by student actions, and holding students accountable for their actions.

Prohibited Conduct, Procedures, and Sanctions

Chapter 5 of the Code (legal.charlotte.edu/policies/up-406#ch5) includes a list of behaviors that are prohibited by the Code, **including, but not limited to**, acts of harm (injury, harassment, relationship violence, etc.), weapons violations, disruption of University activities, drug violations, fire safety, misrepresentation, false identification, theft, vandalism, alcohol violations, sexual misconduct, trespassing, disorderly conduct, hazing, and retaliation. For a full explanation of all

conduct prohibited under the Code, consult Chapter 5 of the Code at legal.charlotte.edu/policies/up-406#ch5.

Important Note: Any alleged conduct occurring on or after August 14, 2020 that meets the definition of one or more of the Title IX Violations (legal.charlotte.edu/policies/up-406#TIXViolations) is not considered Sexual and Interpersonal Misconduct under University Policy 406, Code of Student Responsibility. Alleged Title IX Violations occurring on or after August 14, 2020, are processed according to University Policy 504, Title IX Grievance Policy (legal.charlotte.edu/policies/up-504).

Chapter 6 of the Code (legal.charlotte.edu/policies/up-406#ch6) provides the process for case referrals and adjudication methods.

Chapter 7 of the Code (legal.charlotte.edu/policies/up-406#ch7) provides Conduct Procedures applicable for Formal Charge(s) adjudicated by a Hearing Panel or Administrative Hearing Officer under the Code.

Chapter 8 of the Code (legal.charlotte.edu/policies/up-406#ch8) provides additional Conduct Procedures applicable to alleged Sexual and Interpersonal Misconduct.

Chapter 10 of the Code (legal.charlotte.edu/policies/up-406#ch10) details possible sanctions imposed on Students or Student Organizations found responsible for violating the Code.

Chapter 11 of the Code (legal.charlotte.edu/policies/up-406#ch11) provides information on appeals.

A full explanation of prohibited conduct, and a description of procedures used in cases where violations are alleged, including appeals processes, are found in the complete text of The Code of Student Responsibility, as it may be modified from time to time. Students are advised to contact the Office of Student Accountability and Conflict Resolution or visit legal.charlotte.edu/policies/up-406 to ensure they consult the most recent edition.

THE PROGRAM TO PREVENT USE OF ILLEGAL DRUGS AND ALCOHOL ABUSE

legal.charlotte.edu/policies/up-711

Below is a brief summary of University Policy 711, Program to Prevent Use of Illegal Drugs and Alcohol Abuse. Visit legal.charlotte.edu/policies/up-711 for a full version of that policy.

In keeping with efforts to maintain an environment that supports and encourages the pursuit and dissemination of knowledge, it is the policy of The University of North Carolina at Charlotte to consider the use of illegal drugs or alcohol abuse by students, faculty and staff or by others on premises under University control to be unacceptable conduct that adversely affects the educational environment.

To remind students, faculty, and staff of their responsibilities for maintaining a drug-free environment, this Policy will be distributed throughout the University community each year. Further, the University considers a sound awareness, education, and training program indispensable in combating illegal use of drugs and alcohol abuse, both as a preventive measure and as a remedy. The scope of the University program addresses the awareness needs of students, faculty, administrators, and other staff members and includes the following minimum components.

- The health hazards associated with the use of illegal drugs and alcohol abuse.
- The incompatibility of the use of illegal drugs or abuse of alcohol with maximum achievement of personal, social, and educational goals.
- The potential legal consequences (including both criminal law and University discipline) of illegal drug use and alcohol abuse.
- The effective use of available campus and community resources in dealing with illegal drug use and alcohol abuse problems.

It is the responsibility of all students, faculty, and staff to conduct themselves in a way that contributes to an environment free of illegal drug use and abuse of alcohol. In addition, students, faculty and staff are responsible, as citizens, for knowing about and complying with the provisions of North Carolina law that make it a crime to possess, sell, deliver, or manufacture those drugs

designated collectively as "controlled substances" in Article 5 of Chapter 90 of the North Carolina General Statutes, as well as federal law (Drug Free Workplace Act), which prohibits unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance in the workplace of any employer receiving federal grant funds.

The Director of the Center for Wellness Promotion is responsible for designing and carrying out a program of awareness education and training for students on the subject of preventing the illegal use of drugs and abuse of alcohol. The Center also coordinates a collegiate recovery program, which provides consultation and referral to appropriate facilities in the community for students who may be in need of treatment for substance use disorders and support to students in recovery from chemical dependence.

The Director of the Counseling Center shall, within the limits of available resources, provide services and programs to students seeking assistance with problems of illegal drug use or alcohol abuse. In cases in which the treatment needs of such students exceed the resources of the Center, the Center shall provide referral to appropriate facilities in the community.

The University's program emphasizes collaboration with local resources, including the Center for Prevention Services, Dilworth Center for Chemical Dependency, Anuvia Prevention and Recovery Center, McLeod Addictive Disease Center, Carolinas Medical Center Behavioral Health Services, Eastover Psychological and Psychiatric Group, The Insight Program, Alcoholics Anonymous, Narcotics Anonymous, Al-Anon, and Nar-Anon. To this end, the University shall participate in the Charlotte-Mecklenburg Drug Free Coalition and will work with local advisory boards to further collaborate between the University and the Charlotte community.

The University's awareness, education, and training efforts stress prevention. The goal of these efforts is (1) to encourage non-users of illegal drugs and alcohol to continue to be non-users, (2) to encourage users of alcohol to do so safely and responsibly, and (3) to encourage users of illegal drugs to stop such use.

The use of illegal drugs and the abuse of alcohol are considered by the University to be problems that can be overcome. Therefore, the educational and rehabilitative services cited above are available on a confidential basis. However, the possession, sale, delivery, or manufacture of illegal drugs will not be tolerated on campus or off campus in the event that the interests of the University may be affected.

The University will cooperate fully with law enforcement agencies and will apply appropriate disciplinary procedures should a student violate criminal statutes with regard to illegal drugs or alcohol abuse. Violations may subject a student to prosecution and punishment by civil authorities **and** to conduct action by the University.

When a student has been charged by the University with a violation of policies concerning illegal drug use or alcohol abuse, they may be suspended from enrollment before initiation or completion of regular disciplinary proceedings if the Chancellor or the Chancellor's designee concludes that the student's continued presence within the University community would constitute a clear and immediate danger to the health or welfare of other members of the University community. If such a suspension is imposed, an appropriate hearing of the charges against the suspended person shall be held in accordance with the Code of Student Responsibility.

SMOKING AND USE OF TOBACCO PRODUCTS ON UNIVERSITY PROPERTY

legal.charlotte.edu/policies/up-707

Below is a brief summary of University Policy 707, Smoking and Use of Tobacco Products on University Property. Visit legal.charlotte.edu/policies/up-707 for a full version of that policy.

The University of North Carolina at Charlotte has a vital interest in maintaining a healthy and safe environment for its students, faculty, staff and visitors while respecting individual choice about smoking and use of tobacco products. Consistent with these concerns and with North Carolina law, the following Policy establishes restrictions on smoking and use of tobacco products on University Property and provides procedures for accommodating the preferences of both smokers and non-smokers.

For the purposes of this Policy:

A) "Smoking" is defined as the use or possession of a lighted cigarette, lighted cigar, lighted pipe, or any other lighted tobacco product, or the use of an electronic inhaler that employs a mechanical heating element, battery, or electronic circuit to heat a liquid nicotine solution contained in a vapor cartridge, such as an

electronic cigarette, electronic cigar, electronic cigarillo, or an electronic pipe.

B) "Tobacco product" means a cigarette, a cigar, chewing tobacco, vapor product, or any other product that contains tobacco and is intended for inhalation, oral use, or nasal use. The term does not include nicotine patches, nicotine gum, nicotine lozenges, or other tobacco cessation products.

C) A "Building" is defined as any permanent or temporary structure utilized for the support, shelter or enclosure of people, animals, or property. "Buildings" include, but are not limited to: residence halls; classroom and office buildings; workshops; shuttle, light rail, and bus stops; all recreational and athletic facilities, including athletic fields, gymnasiums, and stadiums; parking decks; stairwells; inside and outside dining areas; vending areas; breezeways; and connectors.

D) A "University Building" is defined as any Building owned, leased as lessor, or the area leased as lessee and occupied by UNC Charlotte.

E) "University Property" means University Buildings and grounds owned, leased, operated, controlled, or supervised by UNC Charlotte.

F) A "University Vehicle" is defined as a vehicle owned or leased by UNC Charlotte.

G) A "Designated Smoking Area" is defined as an exterior area on the UNC Charlotte campus designated by the Chancellor or the Chancellor's designee as a place for smoking. Designated Smoking Areas will be marked by proper signage, and are subject to the provisions in Section III of this Policy.

The following restrictions apply to smoking and use of tobacco products on University Property:

A) Smoking and use of tobacco products is prohibited within all University Buildings.

B) Smoking is prohibited within 100 linear feet of any University Building unless otherwise allowed under subsection III. D.

C) Smoking and use of tobacco products in University Vehicles is prohibited.

D) Smoking is permitted on University Property in Designated Smoking Areas. See the Smoking Policy Map at facilities.charlotte.edu/our-services/maps/printable-campus-maps.

Additional restrictions on smoking or use of tobacco products required for safety reasons may be imposed by the University on a case-by-case basis. Areas with such restrictions will be identified by signage.

Cooperation and consideration between smokers and non-smokers, and between users and non-users of tobacco products is necessary to ensure the successful implementation of this Policy. Effective implementation of this Policy depends upon the courtesy, respect, and cooperation of all members of the University community.

Violation of this Policy may subject a student to conduct action under the Code of Student Responsibility.

NOBLE NINER CODE

studentaffairs.charlotte.edu/niner-code

The Noble Niner Code was authored by the Student Government Association and describes the ideals which every Charlotte 49er student can ideally reach as they become a fully actualized individual.

It was approved by the UNC Charlotte Board of Trustees on April 20, 2007, and is now adopted as an official document of the University.

Scholarship

A Niner shall strive for academic excellence in and out of the classroom while maintaining academic honesty and ethical values.

Integrity

A Niner shall act to uphold and improve one's self, the community, and the high standards of the institution.

Respect

A Niner shall welcome all aspects of individuality and self-worth while embracing the learning opportunities that diversity provides.

Accountability

A Niner shall hold others responsible for their actions while accepting responsibility for one's own.

Dignity

A Niner shall appreciate the intrinsic value of the institution and work to preserve the 49er environment.

Honor

A Niner shall appreciate students, faculty, administration, and staff as contributing members of the University community.

Compassion

A Niner shall demonstrate genuine consideration and concern for the needs, feelings, ideas, and well-being of others.

Character

A Niner shall exemplify all qualities and traits that promote

fellowship and camaraderie among the student body, faculty, staff, and administration.

Nobility

A Niner shall exhibit the virtues and values listed above which befit all members of our Niner Nation.

Degree Requirements and Academic Policies

REGISTRATION

The Office of the Registrar is responsible for the management of the registration process by which students enroll in, drop, and withdraw from courses. Through the registration process, students assume academic and financial responsibility for the courses in which they enroll. They are relieved of these responsibilities only by formally terminating enrollment by dropping or withdrawing in accordance with deadlines specified in the Academic Calendar and the corresponding prorated refund schedule available on the Niner Central website at ninercentral.charlotte.edu/billing-payments-refunds/refunds-financial-aid.

Registration Deadlines

University policies determine when students may enroll or adjust their enrollment in courses. General deadlines are shown below and specific deadlines for a given term are available online at registrar.charlotte.edu/printable-calendar.

Add/Drop Period

The Add/Drop period runs through the 6th business day of the Fall and Spring semesters and on the 2nd business day for Summer full and half terms.

During the Add/Drop Period, students can:

- Register for courses
- Drop a course(s) without record (and remain enrolled in other courses)
- Drop all courses without record
- Change the grade type to Audit or Pass/Unsatisfactory (refer to Auditing Courses below and the Pass/Unsatisfactory Option in the Grading policy)
- Opt out of retaking a course with Grade Replacement (refer to Repeating Graduate Courses in the Grading policy)

After the Add/Drop Period students can withdraw from one or more courses in accordance with the Withdrawal policy.

Prerequisites and Permits

All students, including visitors and non-degree students, are required to meet course prerequisites and to obtain the required permissions to enroll in courses through the department which sponsors the course.

Auditing Courses

With the permission of the instructor and Graduate School, a Graduate Student may audit any course in which space is available. Fees and procedures for this non-credit enrollment are the same as those for a credit enrollment. The procedure for adding, dropping, or withdrawing from an audit course is the same as for credit enrollments. In order to audit a class, a student must complete a Graduate Academic Petition and receive approval from

the instructor and the Graduate School by the withdrawal deadline of a semester.

No student will be allowed to change the designation of a course from audit to credit or from credit to audit after the withdrawal deadline of a semester (or a proportional period for Summer terms). Participation of auditors in course discussions and in tests or examinations is optional with the instructor. Students who audit receive no University credit, but they are expected to attend the course regularly.

Early Entry to Graduate Programs

Exceptional undergraduate students at UNC Charlotte may be accepted into some certificate, master's, and doctoral programs and begin work toward a graduate certificate or degree before completion of the baccalaureate degree. In those programs offering this option, an applicant may be accepted at any time after completion of 75 or more credit hours of their undergraduate coursework, although it is expected that at least 90 credit hours of undergraduate coursework will have been earned by the time the first graduate course is taken. These students will have provisional acceptance status in the graduate program, pending the award of the baccalaureate degree.

To be accepted to this program, the student must complete an application online at gradadmissions.charlotte.edu/apply for the given graduate program and be approved for it. In addition, the student must complete the Early Entry Graduate Academic Petition, which requires approval by the Undergraduate Advisor, the Graduate Program Director, and the Graduate School. The petition is available on the Graduate School website under Current Students. *[Note: The Early Entry Program Petition must be approved by the Graduate School before the student begins the Early Entry graduate coursework. Failure to obtain prior Graduate School approval negates the ability to "double count" courses in an accelerated Early Entry Program.]* An undergraduate student must have at least a 3.2 overall GPA and have taken the appropriate graduate standardized test and earned an acceptable score, if required by the academic program. A given program may have more rigorous admissions criteria. If an Early Entry student has not met the normal admission requirements of a 3.0 overall undergraduate GPA at the end of their baccalaureate degree, they will be dismissed from the graduate program.

Students accepted into an Early Entry Program will be considered subject to the same policies that pertain to other matriculated graduate students. However, the undergraduate program will remain the student's primary program. Early Entry students are eligible only for undergraduate-level financial aid, grants, and tuition awards.* Early Entry students are restricted to 15 credit hours of graduate level coursework prior to the completion of the baccalaureate degree. No courses taken before admission to the graduate program may be applied to a graduate degree.

Some Early Entry Programs permit students to "double count" graduate-level coursework towards outstanding requirements for the undergraduate degree. The maximum number of graduate credits which may be "double counted" towards an undergraduate degree varies by program. However, under no circumstances will more than 12 credit hours be double-counted. Students use the Early Entry Petition to detail which courses they plan to "double count" and which courses will be taken solely for graduate credit. Only those graduate-level courses which are applied towards the undergraduate degree are eligible for undergraduate-level financial aid.

Many graduate programs currently offer an Early Entry option. A list of Early Entry Programs may be found on the Graduate Admissions website at gradadmissions.charlotte.edu/programs/early-entry. To be considered for Early Entry admission, a student must submit a completed application via the Graduate School's admissions system at gradadmissions.charlotte.edu/apply and provide supporting documents.

**Note: While students admitted to an Early Entry Program are not eligible to hold a graduate assistantship since they have not completed a baccalaureate degree, they may be considered for a Student Temporary Wage position. Students admitted into an Early Entry Program pay undergraduate fees and undergraduate tuition for all courses (graduate and undergraduate) for which they register until such time that the baccalaureate degree is completed (typically within two semesters).*

Accelerated Master's Programs

Exceptional undergraduate students may be accepted into an Accelerated Master's Program whereby they simultaneously pursue the baccalaureate and master's degrees and gain invaluable mentoring and research experience along the way. The Accelerated Master's Program may also be accelerated in which up to 12 credit hours earned at the graduate level may be substituted ("double counted") for required undergraduate hours. A list of Accelerated Master's Programs may be found on the Undergraduate Admissions website at admissions.charlotte.edu/academics/accelerated-masters-programs.

In the programs offering this option, an applicant may be considered for admission to the Master's Program directly from high school with a minimum GPA 3.75 or above (on a 4.0 scale) and a minimum score of 1220 on the SAT. For details, see the Undergraduate Admissions website at

admissions.charlotte.edu/academics/accelerated-masters-programs.

Note: Students admitted to an Accelerated Master's Program (undergraduate + graduate degrees) are not eligible to hold a graduate assistantship until their final year of study when they are only taking graduate courses. In the Accelerated Master's Program of study, when only graduate courses are taken (typically the final year of study), students are considered "graduate" students and are charged graduate tuition and fees.

Dual Undergraduate and Graduate Registration

First undergraduate degree students at UNC Charlotte who are required to take fewer than 12 credit hours of undergraduate work to fulfill all requirements for the bachelor's degree may be allowed during their final semester to enroll in certain courses for the purpose of obtaining graduate credit. Dually enrolled students will continue to be considered undergraduate students and be charged for the courses taken at the undergraduate level. To be considered for dual enrollment, students should submit the online graduate application for admission as a post-baccalaureate student, submit a Special Request to the Graduate School requesting permission to be considered for dual enrollment, and attach to the Special Request a program of study outlining the requirements of the first undergraduate degree. The total credit hours to be carried in this status shall not exceed 12 credit hours, of which no more than nine may be for graduate credit. On the basis of work attempted prior to the final semester, such students must meet the grade point criteria for admission to a graduate degree program at the University. No course for which credit is applied to an undergraduate degree may receive graduate credit. Permission to take graduate courses under dual registration does not constitute admission to any graduate degree program at the University. (Undergraduate students may also take graduate courses if admitted to an Early Entry Program or an Accelerated Master's Program.)

Note: Only UNC Charlotte students pursuing their first undergraduate degree are eligible for dual undergraduate and graduate registration. Fifth year undergraduate students (i.e., students pursuing a second undergraduate degree) are not eligible for dual undergraduate and graduate enrollment.

Inter-Institutional Registration

An inter-institutional registration program is available, for a limited number of undergraduate and graduate students, with the University of North Carolina at Greensboro, North Carolina State University, University of North Carolina at Chapel Hill, Duke University, and North Carolina Central University. The registration process is initiated in the Office of the Registrar and requires the approval of the student's College Dean and the Associate Dean of the Graduate School. The proposed course cannot be offered at UNC Charlotte. Enrollment for Inter-Institutional is normally limited to the following:

- **Fall and Spring terms:** two courses per term for a graduate or professional student provided that the student is also registered for the balance of their normal load at UNC Charlotte.

- **Summer terms:** one course per summer term provided the student is also registered for at least three hours per session at UNC Charlotte.

Tuition will be billed by UNC Charlotte for all courses taken, including the Inter-Institutional courses, at the prevailing tuition rate. Fees will be waived at the visiting institution unless there is a special fee associated with a particular course. In such a case, the student is responsible for payment of the fee. Students must adhere to the academic calendar for all adds, drops, and withdrawals at both institutions.

Continuous Registration and Leave of Absence

Graduate students who are in the research phase of their thesis, dissertation, project, or directed study must be continuously enrolled during the Fall and Spring semesters. All graduate students must be enrolled during the semester they plan to graduate, which may include the summer semester. To remain continuously enrolled, graduate students may register for any graduate credit-bearing or, when appropriate, residency course. Graduate students who need to interrupt their studies for up to two consecutive semesters, must seek approval for a Leave of Absence through the Graduate Academic Petition system. Students experiencing a medical emergency or other crisis should contact the Student Assistant and Support Services (SASS) office.

Students in graduate degree programs are required to maintain continuous registration each Fall and Spring semester, excluding Summer terms, for thesis, dissertation, project, or directed study until work is completed. The continuous registration requirement begins with the semester in which the student first registers for thesis, dissertation, project, or directed study. Students working in research laboratories must be granted access in compliance with departmental policy.

Degree-seeking graduate students who are in good standing may request a leave of absence for up to two consecutive Fall and/or Spring semesters with the condition that they will not use University resources during their absence. Graduate students choosing this option must submit a Graduate Academic Petition for a leave of absence. Graduate students who have taken an approved leave of absence for two consecutive semesters must contact the Graduate School to have their

enrollment reactivated prior to the end of the second semester. A leave of absence may impact financial aid, funding, immigration status, and health and wellness services. Graduate students considering these options should first consult with their academic advisor and any other relevant office (i.e., ISSO) to understand the possible ramifications of taking a leave. Graduate students with questions about the leave of absence option are encouraged to contact The Graduate School.

Transfer Credit

Students enrolled in a graduate degree program at UNC Charlotte may transfer graduate credit appropriate to their program earned at UNC Charlotte or other institutions, subject to the conditions stated below. Students may request transfer credit through a Graduate Academic Petition. Students are held to the policies published for the Graduate Catalog year reflected on their degree audit.

Graduate Credit Earned at UNC Charlotte

Students may transfer graduate credit earned at UNC Charlotte under the following conditions:

- The course credit is appropriate to the degree program in which the student is enrolled and subject to approval by the Graduate Program Director and the Graduate School
- The credit earned is within the published program time limits as outlined in the Catalog
- The student received grade of C or above for the course and the overall GPA remains at or above 3.0 (See Academic Standing and Grading and Related Policies in the applicable Graduate Catalog)

Restrictions:

- The capstone requirement for a master's program cannot be transferred
- Up to 9 hours of master's capstone or thesis credit may transfer into a doctoral program as elective credit
- Undergraduate coursework is not transferable for graduate credit
- Coursework taken as part of an earned master's or doctorate degree is not transferable to a degree at UNC Charlotte at the same or lower level

Graduate Credit Earned at Other Institutions

- Master's students may transfer up to 30% of the total credit hours required for a master's degree or certificate program, and doctoral students may transfer up to 30 credit hours from other institutions under the following conditions:
- The course credit is appropriate to the degree program in which the student is enrolled and subject to approval by the Graduate Program Director and the Graduate School
- The credit earned is within the published program time limits as outlined in the Catalog
- The student received a grade of B or above as defined by UNC Charlotte; coursework that has been graded on a Pass/No Credit or Satisfactory/Unsatisfactory basis will be accepted for transfer if equivalent to an A or B grade at UNC Charlotte (See Grading and Related Policies in the applicable Graduate Catalog)

Restrictions:

- Coursework taken as part of an externally earned master's or doctorate degree is not transferable to a degree at UNC Charlotte at the same or lower level
- The capstone requirement for a master's program cannot be transferred
- Graduate credit from other institutions may not be applied to Advanced Standing Tracks for doctoral programs. (See Ph.D. Degree Requirements in the applicable Graduate Catalog)
- Credit taken under the quarter system will be converted to semester hour credit; partial or fractional credits cannot be not awarded
- Graduate courses that appear in the undergraduate section of a transcript are only transferable if they were not counted toward the student's undergraduate degree
- Up to 9 hours of master's capstone or thesis credit may transfer into a doctoral program as elective credit

Credit by Examination

A student currently enrolled in a certificate or degree program at UNC Charlotte may pass a specially prepared challenge examination and receive credit for a University course without having to do the required coursework. The student contacts the program in which credit is sought to request administration of an examination. Since it may not be appropriate to award credit by examination for some courses, the decision to offer an examination is that of the program. If the graduate program authorizes an examination, the student is instructed to pay the fee for credit by examination and to bring the receipt of payment to the examination. Credit by examination will be indicated on the transcript, but no grade points will be awarded. The grade will appear as a Pass or Unsatisfactory grade. Failure on such an examination will incur no grade-point penalty. No student may challenge a course for which either a passing or failing grade has been received at UNC Charlotte.

Change of Degree Program

To change from one degree program to another, a graduate student must complete the application for admission to the new program, pay the requisite application fee, submit a Statement of Purpose, and provide supporting documentation as specified in this

Catalog in a timely manner and be recommended by the Graduate Program Director for admission to the new program of study, with the Graduate School rendering the final decision. The student should also provide the Graduate School with a letter indicating withdrawal from the initial degree program.

Note: Students on F-1 or J-1 visa status who change from one degree program to another may be required to submit proof of sufficient financial resources, especially if the change to another degree program requires the issuance of a new Form I-20 or DS-2019.

Application for the Degree and/or Graduate Certificate

All graduate students, including certificate students, must submit the Online Graduation Application no later than the published deadline in the term of graduation. The Online Graduation Application can be found at my.charlotte.edu under "Student Records". Degrees and certificates are conferred at commencement exercises held at the end of the Fall and Spring semesters; however, the diploma, graduate certificate, and/or transcript will reflect the term in which all requirements were completed. Master's diplomas and graduate certificates are mailed directly to the student after graduation clearance has been completed.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

Degree Audits

DegreeWorks (available via my.charlotte.edu) contains the definitive degree audit for each graduate student, based on the approved curriculum for the program. Students are encouraged to review their individual audit each semester to ensure they are making satisfactory progress towards graduation. In the term of graduation, each candidate's DegreeWorks audit will be reviewed for accuracy by the graduate program and the Graduate School. All program requirements specified in DegreeWorks must be met before the degree or certificate will be awarded. If an audit does not appear accurate, a student should consult with the director of their graduate program to determine if an academic petition is necessary.

Earning a Second Degree

A student is permitted to earn a second graduate degree subject to the following conditions:

1) no work applied to a previously awarded degree may be applied to the new degree program
2) the student must be admitted to a degree program different from that of their previous graduate degree(s)
3) the student must successfully meet all requirements for the new degree

Dual Master's Degrees

In certain instances, it may be possible for a student to obtain dual degrees in two master's programs through the development of an integrated curriculum. A dual master's degree requires a special arrangement and should be viewed as atypical to standard practice. No degree program is obligated to enter into such an arrangement.

Although other restrictions may apply, basic admission and degree requirements are specified below:

The student must apply to each program separately and be admitted to both by the start of the third semester. No admission requirements established by the Graduate School or by either individual program may be waived. For example, if one degree requires acceptable scores for the GRE and the other the MAT, the applicant must take each standardized exam to be considered for admission to both degrees.

1) Once admitted, the student must develop a suitable plan of study that is acceptable to both programs and to the Graduate School. **This plan of study must be done within the first semester of a student's matriculation in the Graduate School and in conjunction with Graduate Program Directors.** The plan of study must be forwarded to the Graduate School for review and approval.
2) In cases where one program offers a concentration, the dual degree will replace the concentration and no concentration will appear on the student's transcript.
3) The student's advisory committee must have representation from both degree programs. If there is no advisory committee, the student must have two advisors; one from each program.
4) The number of required credit hours for both degrees must not be less than 75% of the total minimum hours required to complete each degree separately. For instance, if degree program X requires 30 credit hours and Y 30 credit hours, a proposed dual degree should at a minimum require 45 credit hours.
5) The director of each degree program must agree on which courses may be applied to both sets of graduation requirements.
6) The student must complete the capstone requirements for both programs. For example, if program X requires a written thesis and program Y requires a comprehensive exam, the student must meet both degree obligations.
7) If there is a compulsory qualifying exam in each curriculum, it may be possible for the student to take a single exam as long as the examination committee

agrees that the assessment covers sufficient background information for each discipline. If only one program requires a qualifying exam, the student is obligated to take the exam.

8) If the student withdraws or is suspended from one of the participating programs, the dual degree arrangement is automatically nullified.
9) All standard policies relating to transfer of courses, time to degree, residency requirements, and minimum GPA required to graduate, apply to any dual degree arrangement.
10) All of the coursework in the combined program of study must be completed before the student can apply for either of the degrees.
11) No dual degrees will be awarded retroactively.

Termination of Enrollment

Once a student has registered for classes and it becomes necessary to terminate the registration, there are two possible courses of action: (1) cancellation of enrollment, or (2) withdrawal from classes and/or from the University. The method of registration termination depends upon the circumstances in each individual case.

Cancellation of Enrollment

A Cancellation of Enrollment will be processed for any student who has not paid their tuition and fees or made arrangements by the due date listed on the academic calendar at registrar.charlotte.edu/printable-calendar. A Cancellation Notice will be emailed to the student's UNC Charlotte email address. Other circumstances that may also result in a cancellation include, but are not limited to: being academically ineligible to continue in school; failure to pay tuition and fees; documented emergency; military deployment; and student conduct sanctions.

The Dean of Students Office may authorize a Cancellation of Enrollment through the University's Office of the Registrar within the add/drop period for documented medical or personal crises or for reasons related to military deployment or required military training.

Dropping all courses prior to the last day of the add/drop period is the process by which a student cancels enrollment for the term. A student who wishes to cancel enrollment must do so via My UNC Charlotte at my.charlotte.edu. In cases where a new graduate student fails to enroll in the first term following admission to a graduate program, the Graduate School will withdraw the student's admission.

Withdrawals

Students are allowed opportunities to withdraw themselves from classes and receive a grade of W. The deadline to withdraw from one or more courses (including withdrawal from all courses) is at the 60% completion point of the term. The precise date for each term will be published in the Academic Calendar at registrar.charlotte.edu/printable-calendar. After this deadline, late withdrawal will only be allowed for approved extenuating circumstances. A grade of W will be recorded for each withdrawal without extenuating circumstances. Courses marked W do not count in GPA calculations, but do count in attempted hour calculations for all graduate students.

International students on F-1 or J-1 visa status must carry a full course load each academic semester. *(Some exceptions apply. See the International Student and Scholar Office for further information.)* Students who withdraw from UNC Charlotte are advised to consult the International Student and Scholar Office for information on maintaining valid F-1 or J-1 status, or reinstatement to valid F-1 or J-1 status.

Note: In situations where a student withdraws from all courses, the student must terminate all financial obligations with the University such as financial aid, housing, assistantships, etc., by completing necessary paperwork in each office.

Withdrawals (for Extenuating Circumstances)

Students who experience a current term personal or medical crisis or military deployment may request a withdrawal with extenuating circumstances through the Dean of Students Office. In very rare circumstances, students who wish to request a withdrawal with extenuating circumstances for past terms must submit an academic petition to the Graduate School. If a student's request for a withdrawal with extenuating circumstances is approved, the student will be removed from registered classes with a transcript notation of "WE" and a withdrawal tag will be placed on the student's registration. If a student's request for a withdrawal with extenuating circumstances is denied, graduate students may appeal that decision to the Dean of the Graduate School.

Termination by the University

The University maintains the right to terminate a student's enrollment in a course for a variety of reasons including, but not limited to: course schedule changes, course cancellation due to low enrollment, or the student's nonfulfillment of course prerequisites. The University maintains the right to terminate a student's enrollment in all courses in a term for a variety of reasons including, but not limited to: academic suspension, suspension for violation of the Code of Student Responsibility, or suspension in violation of the Code of Student Academic Integrity. Students who have been suspended for academic or disciplinary reasons must either appeal or reapply for admission as described in the Readmission of Former Students policy. See Academic Standing/Appeal

Procedure.

ACADEMIC LOAD/ TIME STATUS FOR ALL GRADUATE STUDENTS

UNC Charlotte uses a standard Academic Load to determine time status of graduate students for Loan Deferment, Financial Aid, Visa Status, Payroll Tax Withholding, Graduate Student Support Plan Eligibility, and Veteran's Benefits. This Academic Load is the only resource used to determine a student's status for these purposes, and the following definitions apply to all graduate students, U.S. and international, participants and non-participants in the Graduate Student Support Plan.

An appropriate course load is dependent upon two factors: (1) the scholastic ability of the student as reflected by their academic history and (2) the time available for study. A course load of 9 credit hours constitutes a normal full semester program for a graduate student in a Fall or Spring semester, while 6 credit hours constitutes a normal full load in the Summer. This is lower than the normal undergraduate load because of the extensive reading, independent thinking, and individual research required of graduate students. Graduate students should not register for more than 12 credit hours during a Fall or Spring semester or 9 credit hours in a Summer term.

Students who hold an eligible graduate assistantship may hold the assistantship with 6 credit hours, unless they participate in the Graduate Assistant Support Plan (GASP) in which case they must be full-time enrolled as defined below. Students enrolled in 6 credit hours, however, are not considered to be enrolled full-time.

International students on F-1 visa/status are required, by immigration regulations, to pursue a full course load during each academic semester, except during official school breaks (e.g., summer vacation and winter holidays) unless a reduced course load is approved in advance by the Designated School Officer (DSO) at the International Student Scholar Office. Failure to enroll for a full course load without prior approval is considered a violation of the F-1 legal status. International students who hold a graduate assistantship must be full-time enrolled as defined below.

Fall and Spring Semesters

Graduate students enrolled in a doctoral program with a dissertation or in a master's program and pursuing the thesis option.

- Full-Time students must:
  - Enroll in at least 9 credit hours per semester, or
  - Have completed coursework and the number of thesis/dissertation hours for credit in their graduate degree program, as well as the requisite milestones, and are approved to take GRAD 9800 or GRAD 7800 for 3 credit hours (may be repeatable with prior approval), or
  - Have completed everything for their graduate degree program with the exception of the final defense, and the defense is scheduled within four weeks of the beginning of a semester, and are approved to take GRAD 9999 or GRAD 7999 (one time only).
- Three Quarter (3/4) Time: 7-8 credit hours
- Half (1/2) Time: 5-6 credit hours
- Less than Half (1/2) Time: 1-4 credit hours
- Maximum Load: 12 credit hours

Graduate students enrolled in a degree program not requiring a thesis or dissertation.

- Full-Time: 9 or more credit hours
- Three Quarter (3/4) Time: 7-8 credit hours
- Half (1/2) Time: 5-6 credit hours
- Less than Half (1/2) Time: 1-4 credit hours
- Maximum Load: 12 credit hours

Summer Terms

Graduate students enrolled in any program.

- Full-Time: 6 or more credit hours
- Three Quarter (3/4) Time: 4-5 credit hours
- Half (1/2) Time: 3 credit hours
- Less than Half (1/2) Time: 1-2 credit hours
- Maximum Load: 9 credit hours

COURSE ATTENDANCE AND PARTICIPATION

Instructors determine their course policies (including attendance and participation) as long as such policies do not conflict with University policies. Such policies should be pedagogically appropriate. In general, students are expected to attend all scheduled sessions in the courses for which they are registered, participate fully in the learning process, demonstrate respectful behavior while interacting with instructors and peers, and complete all of the course requirements. Instructors may outline additional and more specific standards in the course syllabus, especially when attendance and/or participation are part of the grading criteria for the course.

University-Sanctioned Activities

University-sanctioned events or activities are considered excused absences. A University-sanctioned event or activity is one in which a student formally represents the University to external constituencies in athletic or academic activities. This policy does not supersede individual program attendance and/or participation requirements that are aligned with accreditation or licensure.

Student Responsibilities

1) Notification
   a) A student must inform the instructor of any absence as soon as possible. For any excused absence, a student must inform the instructor no later than the last day of the add/drop period, except when newly added or unforeseen circumstances occur (e.g., a playoff event).
   b) Notification/Documentation of planned excused absences must be made in writing and delivered by the student electronically or in a face-to-face meeting with the instructor of each class that the student is requesting an excused absence.
2) Student experiences that cannot be made up should be discussed with the instructor at the onset of the course to ensure that continued enrollment is feasible while the opportunity to drop the class exists.
3) Students are responsible for fulfilling any course requirements that occur during the time they are absent from class.
4) Students are expected to maintain satisfactory progress in the course.

Instructor Responsibilities

1) Instructors should utilize best practices with regards to course attendance and participation including but not limited to:
   a) Prioritizing active participation in and engagement with the educational process over course attendance as a measure of student involvement.
   b) Establish rules of engagement in the syllabus, clarify the course instruction format as in-person, online (synchronous or asynchronous), or a hybrid of in-person and online, and identify multiple ways in which students can demonstrate satisfactory participation. In hybrid or entirely online courses, for example, this could include camera usage, chat boxes, online forums, etc.
   c) If the course has a policy regarding a limited number of allowed absences, University-sanctioned activities should not count against that limit. In addition, students cannot be required to utilize a "drop" option for work missed afforded to all students due to a University-sanctioned event.
   d) If a student has a valid University-excused absence, they are entitled to make up missed work for full credit in whatever manner the instructor deems appropriate.
2) If student responsibilities are met, the instructor will honor valid University-excused absences that are not already included in other individual instructor excused absences policies,.
3) The instructor may impose appropriate academic penalties if the student fails to satisfactorily complete the alternate assignment or examination within a reasonable timeframe.
4) Required activities outside of class hours that are used for graded participation must be stated in the syllabus. If the required activity falls on a specific date/time, the instructor must provide an alternative assignment, unless the activity is foundational to the course (e.g., a theater performance produced by the class). Such foundational class activities should be included in the course "Notes" in the Banner Schedule. If the activity is one that can be completed over the course of the term and is not limited to a specific date/time, no alternative assignment is required.
5) Additional absences from class may be excused by the instructor. Whenever possible, students are expected to seek the permission of the instructor prior to any absences. Examples of valid reasons for consideration of absences include:
   a) Documented illness
   b) Serious personal or family emergencies
   c) Court-imposed legal obligations such as subpoenas or jury duty
   d) Military obligations
   e) Academic and/or extracurricular activities
   f) Religious observances; absences for religious holidays fall under University Policy 409, Religious Accommodation for Students at legal.charlotte.edu/policies/up-409
   g) Documented quarantining for in-person classes
6) If students believe they have been penalized or unjustly treated because of participation in a University-authorized activity, they can appeal using the following sequence of appeal to (1) the instructor, (2) unit chairperson and (3) the appropriate college dean or designee (college offering the course). The decision of the dean is considered final.

GRADING

Instructors assign grades on the basis of their evaluation of the academic performance of each student enrolled in their courses. At the end of the term, the grades are reported to the Office of the Registrar which is responsible for maintaining student academic records and making

grades available to students.

Grades

Letters are used to designate the quality of student academic achievement.

Graduate Grades		
Grade	Definition	Grade Points per Credit Hour
A	Commendable	4
B	Satisfactory	3
C	Marginal	2
I	Incomplete	
P	Pass	
U	Unsatisfactory	0
SP	Satisfactory Progress	
UP	Unsatisfactory Progress	
W	Withdrawal	
WE	Withdrawal with Extenuating Circumstances	
N	No Credit	
UX	Academic Dishonesty Violation	
AU	Audit	
NR	No recognition given for audit	

Grade of I (Incomplete)

The grade of I is assigned at the discretion of the instructor when a student who is otherwise passing has not, due to circumstances beyond their control, completed all the work in the course. The missing work must be completed by the deadline specified by the instructor, but no later than 12 months. If the I is not removed during the specified time, a grade of U as appropriate is automatically assigned. Time extensions for the completion of an I beyond one year cannot be approved except by a Graduate Academic Petition to the Graduate School under extraordinary circumstances. The grade of I cannot be removed by enrolling again in the same course, and students should not re-enroll in a course in which they have been assigned the grade of I. A grade of I cannot be replaced with a grade of W (Withdrawal).

Grade of P/U (Pass/Unsatisfactory) Option

Certain graduate courses, such as research seminars, tutorials, and internships, may be designated for Pass/Unsatisfactory grading upon recommendation of the offering department and approval of the Graduate Council. The grade of P (Pass) in such a course shall be considered as evidence of satisfactory performance. A grade of U (Unsatisfactory) will affect eligibility for continued enrollment and will not apply toward requirements for the degree. Graduate students may not elect the Pass/Unsatisfactory option for a standard graded course, with the exception of GRAD courses.

Grade of SP/UP (Satisfactory Progress/ Unsatisfactory Progress) Option

The grade of SP (satisfactory progress) or UP (unsatisfactory progress) is assigned to graduate coursework for research activity that extends over more than one semester, typically dissertation or thesis research. In these cases, the research is ongoing so only the progress made in that term can be evaluated. SP indicates the student made acceptable progress as assessed by their advisor. A grade of UP indicates the student did not make agreed upon progress. Neither a grade of SP nor UP will factor into a student's GPA. Credit graded as UP will not count toward the required credit hours for the degree, but will apply toward the total credit hours earned and noted on the transcript.

It is possible for a student to be registered in multiple sections of research in a given semester. The student could earn both SP and UP grades that term, thereby making partial progress. Any grade of UP must be accompanied by written feedback from the faculty advisor, which explains what is expected for a grade of "satisfactory" progress.

The second semester in which a grade of UP is earned will trigger a discussion between the student and advisor about lack of progress in the program. This discussion will include all possible recommendations from the advisor, such as pursuing a new topic, moving to a new advisor or even termination from the program. The advisor will discuss any recommendation to terminate a student for lack of progress with the Graduate Program Director prior to forwarding such a request to the Graduate School for consideration.

Note: Graduate students cannot select the Satisfactory Progress/Unsatisfactory Progress option for a standard graded course.

Grade of W (Withdrawal)

No grade will be given for a course dropped on or before the last day to drop a course without record. After this period, a student is permitted to withdraw from a course with a grade of W, in accordance with the conditions and deadlines of the Withdrawals policy. Post-deadline withdrawal is only allowed for approved extenuating circumstances. Unsatisfactory academic performance itself is not an extenuating circumstance. The date of withdrawal is determined when the "Withdrawal" notification is received by the Office of the Registrar. The grade of W is posted on the academic transcript.

Grade of WE (Withdrawal for Extenuating Circumstances)

After the deadline to withdraw from a course, a student may, in certain circumstances, request to withdraw from their courses based on an extenuating circumstance (i.e., a medical emergency, a death in the immediate family, or other serious event). The student must provide documentation to support their request. WE requests for the current term are submitted through the Office of the Dean of Students. Although rarely granted, WE requests for prior terms are submitted through the Graduate School using the Academic Petition tool. If approved, a grade of WE is noted on the student's transcript.

Grade of N (No Credit)

The grade of N (No Credit) is used in very special circumstances. The N grade signifies that there is no credit given for the course. Therefore, any course that receives the N grade does not enter into the student's grade point average. The N grade is used for the master's and doctoral level, resident and non-resident, and graduate student continuing registration courses (GRAD 7999 or GRAD 9999). The N grade is also used to replace IP grades which have expired, and for GRAD 8990. These are the only three uses for the N grade.

Grade of UX (Academic Dishonesty Violation)

For details on the use of the UX grade, please see University Policy 407, Code of Student Academic Integrity, Section IV - Penalties at legal.charlotte.edu/policies/up-407#IV.

Grade Point Average (GPA)

The grade point average for a graduate student is based only on those graduate courses taken at UNC Charlotte. It is determined by multiplying the number of grade points for each grade (A=4, B=3, C=2, U=0) by the number of credit hours credit received in that courses adding all accumulated grade points together, and then dividing by the total number of credit hours the student has attempted except those for which the student received a grade of I, IP, SP, UP, W, P, N, AU, or NR. When a course not listed as "May be repeated for credit" is repeated, no additional credit hours attempted accrue and the hours earned and grade points of the previous grade are replaced by those of the current grade in their degree plan of study.

Graduate students must have a 3.0 GPA in the courses on their degree plan of study in order to graduate. However, the grades for all courses attempted will remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript (except as described in the above paragraph).

Repeating Graduate Courses

Graduate students are allowed to repeat a maximum of two courses in which the student has been assigned a grade of C or U (but not an I). If the course grade has resulted in suspension or termination of enrollment, the student must appeal to be reinstated in order to repeat the course. A given course may be repeated one time only. Each grade earned in a repeated course is shown on the student's transcript. The record of the first attempt remains a part of the student's permanent record and counts in the number of marginal (C) grades accumulated and the overall GPA. However, the hours earned and grade in the first attempt are not computed in the program GPA used for graduation clearance. Successfully repeating a course does not change the number of marginal (C) grades accumulated. Enrollment will be terminated if a student receives a grade of U in a repeated course for which the student previously earned a U.

Final Grades

Final grades are available through the secure student access pages of My UNC Charlotte online at my.charlotte.edu.

Final Grade Changes and Appeals from Final Course Grades

When a final course grade other than Incomplete (I) is officially reported by the instructor at the end of an academic term, the grade is recorded by the Office of the Registrar and can be changed only if the grade has been assigned arbitrarily or impermissibly as defined in University Policy 410, *Policy and Procedures for Student Appeals of Final Course Grades*, available online at legal.charlotte.edu/policies/up-410.

For guidelines on applying this policy, please visit University Policy 411, *Request for Review of a Final Course Grade Guidelines for Students*, online at legal.charlotte.edu/policies/up-411.

Students should follow the procedures outlined in that policy if they believe that the final course grade that has been assigned is incorrect. The policy encourages the student to discuss the grade with the instructor as soon as possible after the grade is received. Students should note, however, that the University is not obliged to respond to a grade appeal unless the student files it with the appropriate department chairperson or interdisciplinary program director within the first four weeks following the last day of the regular semester or the summer term in which the grade was received. When a grade is assigned consistent with University policy, only the instructor has the right to change the grade except as provided in the Incomplete grade policy. When an instructor reports a grade change for a grade other than I, the Change of Grade request

must be approved by their Department Chairperson and the Graduate School.

ACADEMIC STANDING

Requirements for Continued Enrollment

All graduate students whether degree seeking or non-degree seeking (post baccalaureate) must maintain satisfactory grades. In addition, students enrolled in any graduate program must maintain satisfactory progress toward the degree. Students are expected to achieve a commendable or satisfactory grade (A or B) in all coursework attempted for graduate credit. Students who fail to maintain satisfactory progress toward their degree or who do not achieve commendable or satisfactory grades in all their graduate coursework are subject to suspension and/or termination from their program of study and/or the Graduate School.

International students on F-1 or J-1 visa status must carry a full course load each academic semester (Some exceptions apply. See International Student/Scholar Office for further information.) Students who are suspended or terminated from their program of study are advised to consult the International Student/Scholar Office for information on maintaining valid F-1 or J-1 status, or reinstatement to valid F-1 or J-1 status.

Academic Suspension

All graduate students (degree/certificate seeking and post baccalaureate) are subject to academic suspension. An accumulation of three marginal C grades in any graduate coursework will result in suspension of the student's enrollment. If a student makes a grade of U in any graduate course, enrollment will be suspended. A graduate student whose enrollment has been suspended because of grades is ineligible to register in any Fall or Spring semester or Summer term unless properly reinstated through the appeal process.

Note: Some departments and/or programs have stricter regulations on suspension than those of the Graduate School. See the academic regulations presented in the program specific sections of this Catalog.

Appeal Procedure

Graduate students may appeal a suspension or termination using the procedures described in the following paragraphs. Other grievances relating to academic status are to be addressed to the Graduate School. For additional information on grievances, see University Policy 411, Student Grievance Procedure, online at legal.charlotte.edu/policies/up-411.

Appeal of Academic Suspension for the Purpose of Reinstatement

A student who has been suspended from the Graduate School and/or a program of study may appeal their suspension and must be reinstated in order to continue their studies. After notification of suspension is received, the student initiates the appeal procedure by submitting a Suspension Appeal Form, available through the online Graduate Academic Petition, to the Graduate Program Director of their academic program explaining any extenuating circumstances. Pending approval, the Graduate Program Director will provide a recommendation regarding reinstatement to the Graduate School. Non-degree seeking licensure students in the College of Education, submit the Suspension Appeal Form to the Associate Dean of the College of Education. All other non-degree seeking students submit the Suspension Appeal Form, available through the online Graduate Academic Petition. The Associate Dean of the Graduate School makes the decision on the suspension appeal and notifies the student of the decision in writing.

A student readmitted to a graduate program through reinstatement will be expected to complete the degree program with satisfactory or commendable performance (A or B grades). Should a student receive a grade of C or U in a graduate course after being reinstated to the program, enrollment in the graduate program will be terminated.

A student who is denied readmission through the suspension appeal process is considered to be terminated from the Graduate School and/or the graduate program. Terminated students may appeal their termination as identified in the section entitled "Appeal of Academic Termination for the Purpose of Reinstatement."

Academic Termination of Non-Degree Seeking Students

Academic termination of non-degree seeking (post-baccalaureate) students may occur in two ways.

1) A student's graduate status will be terminated if, after receiving an initial suspension (see "Academic Suspension") and subsequent reinstatement (see "Appeal of Academic Suspension for the Purpose of Reinstatement"), the student receives a grade of C or U in a graduate-level course.

2) A student's graduate studies may be terminated if they fail to maintain the general standards of the Graduate School (e.g., accumulation of more than one C grade in a term resulting in a total of four or more C grades in their graduate academic record, three C grades and one U, or two or more U grades in a single term).

3) Students who are suspended from the Graduate

School and are denied re-admittance through the suspension appeal process (see "Appeal of Academic Suspension for the Purpose of Reinstatement") are considered terminated from the Graduate School.

Academic Termination of Degree/Certificate Seeking Students

Academic termination of a degree/certificate graduate student's program of studies may occur in four ways.

1) Students may be required to terminate their graduate studies if they fail to maintain satisfactory academic progress. One example of failure to maintain satisfactory academic progress is non-adherence to the schedule of "Time Limits for Degrees."

   When a program determines that a student is making unsatisfactory progress, the program notifies the student in writing of the program's concern about the student's performance. Such a warning specifies the source of the concern, the applicable program and/or Graduate School rules, and the proposed action. Warnings specify when and on what basis a recommendation for academic termination will be considered by the program. A probationary period of one academic semester is normal.

   Following the probationary period, a student who fails to meet the provisions of the warning is subject to termination from the program. If the program believes that termination is warranted, the graduate program director or coordinator communicates to the Associate Dean of the Graduate School in writing the specific reasons involved, all warnings communicated to the student, the program and/or advisory committee procedures and actions leading to the recommendation, and the mailing address of the student. After considering all of the information, the Associate Dean will make a decision. If the decision is to terminate, the Associate Dean will notify the student of their termination from the Graduate School.

2) A student's graduate studies may be terminated if they fail to maintain the specific standards of the student's academic program as described in the program specific sections of the *Graduate Catalog* (e.g., a doctoral program may indicate that the accumulation of two C grades or one U grade is grounds for termination from the program) or the general standards of the Graduate School for termination (e.g., accumulation of more than one C grade in a term resulting in a total of four or more C grades in their graduate academic record, three C grades and one U, or two or more U grades in a single term).

   Note: A graduate student may be terminated without prior suspension if they receive four C grades, regardless of the semester in which the grades were received.

3) A student's graduate studies will be terminated if, after receiving an initial suspension (see "Academic Suspension") and subsequent reinstatement (see "Appeal of Academic Suspension for the Purpose of Reinstatement"), the student receives a grade of C or U in a graduate level course.

4) Students who are suspended from a graduate program and are denied re-admittance through the suspension appeal process (see "Appeal of Academic Suspension for the Purpose of Reinstatement") are considered terminated from their graduate program.

Readmission of Terminated Graduate Students

Students who have been academically terminated from the Graduate School and/or a UNC Charlotte graduate program are not eligible for readmission as either a degree seeking or non-degree seeking graduate student. However, if **after two years** the student can demonstrate the potential for academic success and/or personal and professional development since leaving the University, the student may initiate a request for readmission to the Graduate School. The student may initiate the request for readmission to the program from which they were terminated, to a different graduate program, or as a post-baccalaureate student. Students seeking readmission must submit a new application package which includes the full set of materials identified in the section entitled "General Application Requirements for Admission." In addition, the student must include within their essay (Statement of Purpose) a section explaining the circumstances that led to their termination from the UNC Charlotte Graduate School and a discussion of the academic and/or personal and professional development since last attending the University that has prepared them for a successful return to graduate studies.

Appeal of Academic Termination for the Purpose of Reinstatement (Post-Baccalaureate Students)

While an action of termination is considered final, a post-baccalaureate student who is terminated may appeal that termination to the Graduate School if there are unusual or extenuating circumstances.

To initiate an Appeal of Academic Termination, the student must send a written letter to the Graduate School requesting consideration of their case by the UNC Charlotte Graduate School Appeals Committee. In the written request, the student must make their case for reinstatement. The student must include two letters from

UNC Charlotte faculty or academic administrative personnel who are knowledgeable of the student's academic capabilities and are supportive of the student's reinstatement to the Graduate School. A termination appeal request and the supporting documentation must be received by the Graduate School within 30 days of the date on the letter of termination.

Once the Graduate School receives the Appeal of Termination, it will be forwarded to the Chair of the Graduate School Appeals Committee. This Committee will review all relevant materials and make a recommendation to the Dean of the Graduate School. The Dean of the Graduate School makes the decision on the Appeal of Termination case and their decision is final.

Appeal of Academic Termination for the Purpose of Reinstatement (Degree-Seeking Students)

While an action of termination is considered final, a student who is terminated from a graduate program may appeal that termination to the Graduate School if there are unusual or extenuating circumstances. The type of academic termination will determine the permissible grounds for the appeal and the specific procedure utilized.

Category 1: Academic Termination Based on Failure to Maintain Commendable or Satisfactory Performance in Coursework

Category 1 appeals are available to students who have been terminated for receiving a U or C grade after an initial suspension and students who fail to maintain the specific grading standards of an academic program. In these cases, an Appeal of Academic Termination submitted to the Graduate School must be supported by the student's graduate program. Without support from the student's graduate program, academic termination of this type is always considered a final action.

To initiate a Category 1 Appeal of Academic Termination, the student must send a written letter to the Graduate School requesting consideration of their case by the UNC Charlotte Graduate School Appeals Committee. In the written request, the student must make their case for reinstatement. Included with the student's letter must be at least two letters of support for reinstatement from the student's academic program. For master's degree students, the termination appeal should include a letter from the program coordinator/director and a letter from the department chair, major advisor and/or the thesis/project advisor. For a doctoral student, a termination appeal should include a letter from the program coordinator/director and the advisory committee or dissertation committee chair. The letters from the program must specify what expectations must be met by the student if they are readmitted to the program. A termination appeal request and the supporting documentation must be received by the Graduate School within 30 days of the date on the letter of termination.

Once the Graduate School receives a Category 1 Appeal of Termination, it will be forwarded to the Chair of the Graduate School Appeals Committee. This Committee will review all relevant materials and make a recommendation to the Dean of the Graduate School. The Dean of the Graduate School makes the decision on the Appeal of Termination case and their decision is final.

Category 2: Academic Termination Based on Programmatic Action

Category 2 appeals are for students who have been terminated for failure to maintain satisfactory progress in an academic program and for students who have been denied re-admittance through the suspension appeal process. Academic decisions based on the disciplinary expertise and judgment of graduate faculty members and program coordinators/directors in a particular field are not subject to appeal. The fact that a programmatic decision goes against a student's desire for continuation in an academic degree program is not grounds for a termination appeal. However, a Category 2 appeal may be brought on the grounds that there was "procedural error" or "discrimination" in the termination decision.

To initiate a Category 2 Appeal of Academic Termination, the student must send a written letter to the Graduate School requesting consideration of their case by the UNC Charlotte Graduate School Appeals Committee. In the written request, the student must make their case for reinstatement. If the student is alleging "procedural error," the student must specify what procedures were utilized and how the program deviated from the specified procedures. If the basis of the appeal is "discrimination," the student must show how their case was handled substantially different from those of other students in similar circumstances. A termination appeal request and the supporting documentation must be received by the Graduate School within 30 days of the date on the letter of termination.

Once the Graduate School receives a Category 2 Appeal of Termination, it will be forwarded to the Chair of the Graduate School Appeals Committee. The Chair of the Appeals Committee will contact the program in question and request a response to allegations of "procedural error" and/or "discrimination." The program will have two weeks to respond to the request of the Appeals Committee Chair. Once all relevant information had been received, the Committee will review the materials and make a recommendation to the Dean of the Graduate School. The Dean of the Graduate School makes the decision on the Appeal of Termination case and their decision is final.

Graduate School Appeals Committee

The Graduate School Appeals Committee is authorized to review appeals for reinstatement from graduate students who have been academically terminated. The Committee does not hear grade appeals, for which a separate procedure exists. The Appeals Committee is comprised of four members. The Associate Dean of the Graduate School serves as the ex officio, non-voting chair of the committee. The three voting members of the Appeals Committee are graduate faculty members named by the Dean of the Graduate School.

DISCIPLINARY SUSPENSION

Readmission is not automatic for graduate students suspended for disciplinary reasons. To be considered for readmission, a graduate student must reapply to the Graduate Admissions Office using the online application. An explanation of the circumstances surrounding any disciplinary suspension must be included in the Campus Safety section of the application for admission. Similarly, the applicant must meet all requirements established by the academic program and/or the University before readmission will be considered. (See the "UNC Charlotte Code of Student Responsibility" for a more complete discussion of disciplinary suspension.)

MASTER'S DEGREE REQUIREMENTS

Residence Requirements

No more than twenty percent (20%) of the total credit hours required will be accepted for transfer into a master's degree program. All other work must be residence credit.

Residence credit is credit that is earned under the conditions specified herein and may be applied toward the attainment of graduate degrees at UNC Charlotte. These conditions must be satisfied regardless of the location (on campus, online, or distance) in which the course is given.

Instruction

The instructor must be a member of the UNC Charlotte Graduate Faculty.

Course(s)

The content of each course must be approved by regularly established college, Graduate School and University curricular processes before the course is scheduled or offered.

Residence credit may also be awarded by virtue of an examination administered by the Graduate Faculty of the department offering credit. A student may also, with the prior approval of the appropriate UNC Charlotte department and the Dean of the Graduate School, take graduate courses for residence and course credit at a college or university accredited by an accepted accrediting body.

Advisory Committee

All students in graduate programs must have a graduate advisor who is a regular member of the Graduate Faculty in the student's major program. The graduate advisor appointment must be approved by both the Graduate Program Director and the Graduate School. Students completing a master's thesis are required to establish an advisory committee, with the graduate advisor serving as chair or co-chair. Master's programs may choose to require an advisory committee in cases where a student is not completing a thesis, such as a master's project and/or final oral examinations.

In all situations requiring a committee, the committee will consist of at least three graduate faculty members, one of whom is designated as chair. For students completing a master's thesis, the appointment of the master's thesis committee form should be approved by the Graduate School prior to the student's proposal defense.

Program Approval

Each student's individual program of study must be approved by their department/college. A maximum of twenty percent (20%) of the total credit hours may be included in the approved program of study.

Minimum Hours and Quality

A student is expected to satisfactorily complete a minimum of 30 or more credit hours of approved graduate level courses, depending upon their individual program, with a GPA of 3.0 or above in courses on the degree plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the degree plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Culminating Experience

The intent of graduate education is to provide exposure and training in a specific discipline, culminating in an independently researched comprehensive demonstration of a student's competence in the field. For both the Master of Arts (M.A.) and Master of Science (M.S.) degrees, the culminating experience is normally a thesis or written comprehensive examination. In some cases, M.A. or M.S. programs may substitute another culminating experience, such as an independent research project, internship, portfolio, or capstone course. Such substitutions must be formally approved through the graduate curriculum review process. Students must be enrolled during the semester in which they take the comprehensive examination or any other type of culminating experience.

A few graduate programs offer professional (non-research) master's degrees in designated fields. Most professional master's programs at UNC Charlotte require a culminating experience. In rare cases, a professional master's degree program may seek approval, via the graduate curriculum review process, to waive the culminating experience requirement provided the program can sufficiently demonstrate that this practice is consistent with the guidelines of its field and/or accreditation requirements. *(Note: The culminating experience requirement cannot be waived for individual students.)*

Comprehensive Assessment

The plan of study for a master's degree may or may not include a comprehensive assessment. Comprehensive assessments are administered written and/or orally by graduate program faculty. Students should refer to their program for the exam deadline. Students who fail a comprehensive assessment are subject to termination and should discuss options with their graduate program director. With program approval, a comprehensive assessment may be retaken one time. If the student fails the exam a second time, the program may, in rare circumstance and with compelling evidence, allow a student to, within four months, retake the exam (or portion of the exam). In such cases, the program must document the circumstances under which the student is allowed to retake portions of the exam and demonstrate that the student's committee unanimously supports the decision. Documentation must be submitted to the Graduate School for review prior to the exam date. In no instance will the student be allowed to take the exam (or portion of the exam) a fourth time. Students may only appeal a termination to the Graduate School if their appeal to retake the exam is based on a procedural error or discrimination (please see the Category 2 appeal description under *Appeal for Academic Termination*) and their initial appeal to the program was denied.

Thesis

The plan of study for a master's degree may or may not include completion of a thesis. The thesis and non-thesis approaches are designed to meet the needs of students preparing for different types of careers and represent qualitatively different educational experiences. Consequently, the academic departments and the Dean of the Graduate School discourage any switching from one plan to another. Master's thesis credit can be graded using either the standard letter grade or SP/UP grade mode option, but must be graded each semester. If a switch from a thesis to non-thesis plan is approved, the student must submit a graduate academic petition to withdraw from the thesis credit. The grade of IP for the thesis work will be changed to W on the transcript with no refund of tuition for the course(s). Students pursuing the thesis option must successfully defend a proposal of their thesis topic. It is expected that all thesis committee members be present for both the thesis proposal defense and for the thesis final defense. Upon successful defense of the proposal, students should submit the Proposal Defense for Doctoral Dissertation and/or Master's thesis form to the Graduate School. This form is available on the Graduate School website.

The thesis should be submitted for final approval by the student's thesis committee at least three weeks before the date of the oral examination in which the thesis is defended. Following the successful completion of this defense, the master's candidate must submit a copy of the approved and error-free thesis to the Graduate School (via ProQuest) no later than the filing date indicated in the University Calendar. Guidelines for the preparation of the thesis are available online on the Graduate School website under Current Students. Additionally, the student must submit the Defense Report for Doctoral Dissertation and/or Master's thesis form and the original thesis title page to the Graduate School (with original signatures).

As a research university, UNC Charlotte contributes to the scholarly community through the work of faculty and graduate students. Students are required to submit their dissertation or thesis to ProQuest, an online repository for scholarly work. Although the author of the work retains the copyright, open access may impact the likelihood of publication in some journals. More information is available at www.ProQuest.com.

Under certain circumstances, research may need to be temporarily withheld from publications or "embargoed." Such restrictions may be requested when a:

a) patent application is expected;
b) publication has been submitted to a journal and the publisher's copyright excludes publication of the work in ProQuest. In this case, a screen shot of the journal policy must be included.
c) contract with an outside entity, such as a government agency, requires that the research be embargoed

temporarily.

To request an embargo of a dissertation or thesis, the student and the advisor must submit a request to the Graduate School, which will include supporting documentation. Embargoes may be requested for up to one year, after which time the document will be made available through ProQuest. In extraordinary circumstances, an extension to the embargo may be requested. This form is available on the Graduate School website under Current Students. Embargo requests should be submitted three weeks prior to the final defense date, when possible.

Time Limit

All requirements for the master's degree must be completed within seven (7) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than seven years may be applied towards a master's degree (including transfer credit). Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Courses and Other Requirements

The courses and other requirements for specific degree programs are presented in each of their individual sections throughout this *Catalog*. Students are encouraged to review their individual DegreeWorks audit prior to registration to ensure they are making sufficient progress towards graduation.

Application for Degree

Students who are co-enrolled in a master's and doctoral program should be enrolled in both programs for two academic terms prior to graduation from either degree. Students should submit the Online Graduation Application at the beginning of the term in which they anticipate completion of the master's program. Adherence to Graduate School deadlines is expected. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

PH.D. DEGREE REQUIREMENTS

A doctoral degree is conferred by the University after the student has demonstrated outstanding scholarship in an approved program of study. Candidates must satisfy all University degree requirements in addition to all standards established by the doctoral faculty of their particular program. Specific program degree requirements are listed under the respective doctoral programs in this *Catalog*. In some cases, requirements in a given program are more stringent than the minimum requirements established by the Graduate School.

Ordinarily, a student must complete at least 72 post-baccalaureate credit hours in order to earn the Ph.D. In cases where a student has earned a master's degree in a relevant field from UNC Charlotte or another institution, the student may be permitted to pursue advanced standing within their Ph.D. program. Such advanced standing must be approved through the graduate curriculum review process and appear in the program-specific sections of this *Catalog*.

Advisory Committees

All students in graduate programs must have a graduate advisor who is a regular member of the Graduate Faculty in the student's major program. The advisor is typically the chair of the student's dissertation committee. When there is a compelling reason to do so, another faculty member may serve as "co-chair."

For doctoral students, the dissertation committee will consist of at least four Graduate Faculty members, one of whom is appointed by the Dean of the Graduate School as the Graduate Faculty representative. Dissertations are chaired by graduate faculty and are selected by agreement between the student and the faculty member.

The committee for doctoral students is indicated on the Appointment of Doctoral Dissertation Committee form (available in the Graduate School office or online). At the time that the Appointment of Doctoral Dissertation Committee form is approved, the Graduate School appoints the Graduate Faculty Representative to serve on the doctoral committee.

Graduate Faculty Representative

The graduate faculty representative is a member of the doctoral student's advisory committee appointed by the Graduate School. Advisors may recommend to the Graduate School a faculty member who meets the relevant criteria (below). Recommendations should accompany the initial Committee form. The graduate faculty representative must assure that the doctoral student is treated fairly and impartially by their advisory committee, and assure that University standards and policies are upheld. For these reasons, faculty serving in this role should hold tenure and a Regular Graduate Faculty membership, have served on a dissertation or thesis committee prior to this appointment and come from a department different than the student and chair. This faculty member's role is primarily but not totally procedural. The faculty member may also participate in the development and evaluation of the student's research to the extent appropriate for the faculty member's background. The Graduate Faculty Representative is a full voting member of the committee. This representative is appointed prior to the student's dissertation proposal defense and must participate in the formation of the student's topic and in the final dissertation examination.

Advanced Standing Tracks for Doctoral Programs

Doctoral students who enter with a relevant master's degree may be admitted to an Advanced Standing track in some doctoral programs. In those programs offering this option, the Graduate Program Director must recommend admission to the Advanced Standing track for the term in which the student begins their graduate study. This accelerated track must consist of a minimum of 42 credit hours (including GRAD 8302, GRAD 8990, and 18 credit hours of research).

Note: Courses taken as part of the student's master's program will not be accepted for transfer credit in such cases. However, up to 6 credit hours completed as a post-baccalaureate student may be considered for transfer into a doctoral program with an Advanced Standing track.

Program of Study

Students pursuing a Ph.D. who are not enrolled in advanced standing are eligible to transfer a maximum of 30 credit hours from another institution. In situations where a student is pursuing a master's degree and a Ph.D. simultaneously at UNC Charlotte, up to 30 credit hours may be shared between the two programs, provided that the student completes the master's degree before or concurrently with the Ph.D. Only those courses appropriate for the approved program and curriculum in which the student is enrolled may be transferred or shared. Appropriate courses should be determined by the student's supervisory committee and approved by the program director before the request is submitted to the Graduate School. This rule applies whether the courses were taken at UNC Charlotte or elsewhere and whether a master's degree was earned or not.

No more than six credit hours taken when the student was in post-baccalaureate (non-degree seeking) status may be applied toward the doctoral degree.

Students are expected to satisfactorily complete all required coursework with a GPA of 3.0 or above in courses on the degree plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the degree plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Time Limit

All requirements for the Ph.D. must be completed within nine (9) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than nine years may be applied towards a research doctoral degree (including transfer credit). Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Residence

All doctoral students are required to complete a substantial residency requirement during which they have sustained contact with the graduate faculty. This requirement is specified in the program descriptions.

Qualifying Examination

Each student must complete a qualifying examination. Ordinarily students who enter a Ph.D. program directly from a baccalaureate program sit for this examination

before the end of their third post-baccalaureate year in the program while students who enter a Ph.D. program from a master's degree program take the examination before the end of their first year in the doctoral program. To sit for this examination, the student must have at least a 3.0 GPA and must have removed any conditions upon admission. Qualifying assessments are administered by graduate program faculty. Students who fail a qualifying assessment are subject to termination and should discuss options with their graduate program director. With program approval, a qualifying assessment may be retaken one time. If the student fails the exam a second time, the program may, in rare circumstance and with compelling evidence, allow a student to, within four months, retake the exam (or portion of the exam). In such cases, the program must document the circumstances under which the student is allowed to retake portions of the exam and demonstrate that the student's committee unanimously supports the decision. Documentation must be submitted to the Graduate School for review prior to the exam date. In no instance will the student be allowed to take the exam (or portion of the exam) a fourth time. Students may only appeal a termination to the Graduate School if their appeal to retake the exam is based on a procedural error or discrimination (please see the Category 2 appeal description under *Appeal for Academic Termination*) and their initial appeal to the program was denied.

Candidacy

The dissertation topic may be proposed after the student has passed the qualifying examination. The dissertation topic proposal must be defended at a meeting of the student's advisory/dissertation committee. A written dissertation proposal must be submitted to the advisory/dissertation committee at least two weeks prior to the scheduled defense. A doctoral student advances to candidacy after the dissertation proposal has been approved by the student's advisory/dissertation committee and the Graduate School. Results of the dissertation proposal defense should be submitted to the Graduate School via the Proposal Defense for Doctoral Dissertation and/or Master's thesis form directly after the defense. Candidacy must be achieved at least one term prior to the term of graduation.

Dissertation

The doctoral program of study must include 18 hours of research credit, including dissertation credit. The doctoral candidate must be continuously enrolled in dissertation credit hours (Also see: Student Responsibility - Continuous Registration) beginning with the semester after the dissertation topic proposal is approved until the semester of graduation.

It is expected that all dissertation committee members be present for the dissertation proposal defense and for the dissertation final defense. If there is an exceptional case in which a committee member needs to participate in the proposal or final defense from a remote location, the student and all committee members must assure that all the conditions listed on the Approval of Remote Committee Participation Form are met. This form is available online on the Graduate School website under Current Students and must be completed and returned to the Graduate School at least two weeks prior to the scheduled proposal or final defense.

The dissertation must be submitted for final review by the student's committee at least two weeks before the date of the final examination in which the dissertation is defended. Following the successful completion of this defense, the doctoral candidate must submit one electronic copy of the approved error-free manuscript to the Graduate School (via ProQuest) no later than the filing date indicated in the University calendar. Guidelines for the preparation of the dissertation are available online on the Graduate School website under Current Students. Each student must submit the Defense Report for Doctoral Dissertation and/or Master's thesis form, the Submission and ETD Signature form, and the original dissertation title page to the Graduate School (with original signatures).

The Graduate School requires publication of the dissertation through ProQuest, an online database of dissertations. The student is responsible for paying the optional copyrighting fees. Any other arrangements for publications of the dissertation must not interfere with publication through ProQuest. It may be appropriate for some students to restrict access to their dissertation temporarily (such as when a patent application is pending). In these cases, the student and their committee must submit an embargo request to the Graduate School explaining why restricted access is needed.

As a research university, UNC Charlotte contributes to the scholarly community through the work of faculty and graduate students. Students are required to submit their dissertation or thesis to ProQuest, an online repository for scholarly work. Although the author of the work retains the copyright, open access may impact the likelihood of publication in some journals. More information is available at www.ProQuest.com.

Under certain circumstances, research may need to be temporarily withheld from publications or "embargoed." Such restrictions may be requested when a:

a) patent application is expected;
b) publication has been submitted and the publisher's copyright excludes publication of the work in Proquest. In this case, a screen shot of the journal policy must be included.

c) contract with an outside entity, such as a government agency, requires that the research be embargoed temporarily.

To request an embargo of a dissertation or thesis, the student and the advisor must submit a request to the Graduate School, which will include supporting documentation. Embargoes may be requested for up to one year, after which time the document will be made available through ProQuest. In extraordinary circumstances, an extension to the embargo may be requested.

Final Examination

Each candidate must pass a final examination over the contents of the dissertation. Sometimes called the "dissertation defense" or the "dissertation oral," this meeting is open to all members of the University community and must be announced to campus. The announcement of the final defense can be uploaded by the advisor to the Graduate School website at least 10 days prior to the date and disseminated through the Academic Affairs listserv. The announcement of the dissertation defense should include identification of the student's full name, the date of the defense, the location of the defense, the time of the defense, the title of the dissertation, the name of the Chair of the dissertation committee, and a brief Abstract of the dissertation. **The defense constitutes the final exam for a doctoral student. The decision of the faculty advisory committee is final.** In the rare event of a split decision, typically the faculty come to an agreement as to whether the student defense is acceptable. It is the responsibility of the committee chair to work within their ability to resolve any impasse among committee members. If no resolution is feasible, then the chair should consult with the Graduate School. No student is permitted to take the final examination more than twice.

Application for Degree

Students who are co-enrolled in a master's and doctoral program should be enrolled in both programs for two academic terms prior to graduation from either degree. Students should submit the Online Graduation Application at the beginning of the term in which they anticipate defending their dissertation. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

DBA DEGREE REQUIREMENTS

The Doctor of Business Administration (D.B.A.) degree is conferred by the University after the student has successfully completed all requirements in an approved doctoral program of study in the College of Business. Specific program degree requirements are described in the College of Business section of this *Catalog*.

Program of Study

All credits for the DBA degree must be completed in-residence at UNC Charlotte. Students are expected to satisfactorily complete all required coursework with a GPA of 3.0 or above in courses on the degree plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the degree plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Time Limit

All requirements for the DBA must be completed within nine (9) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than nine years may be applied towards a research doctoral degree (including transfer credit). Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Qualifying Assessment

Upon approval of the dissertation topic, the student begins

to develop their research project. The student's dissertation proposal serves as the primary component of the qualifying assessment for the DBA program. Students who fail a qualifying assessment are subject to termination and should discuss options with their graduate program director. With program approval, a qualifying assessment may be retaken one time. If the student fails the assessment a second time, the program may, in rare circumstance and with compelling evidence, allow a student to, within four months, retake the exam (or portion of the exam). In such cases, the program must document the circumstances under which the student is allowed to retake portions of the exam and demonstrate that the student's committee unanimously supports the decision. Documentation must be submitted to the Graduate School for review prior to the exam date. In no instance will the student be allowed to take the exam (or portion of the exam) a fourth time. Students may only appeal a termination to the Graduate School if their appeal to retake the exam is based on a procedural error or discrimination (see the Category 2 appeal description under *Appeal for Academic Termination*) and their initial appeal to the program was denied.

Admission to Candidacy Requirements

The dissertation topic may be proposed after students have completed the required coursework. The proposal defense serves as the qualifying exam. Students are recommended for admission to candidacy after their Advisory Committee and the Dean of the Graduate School approve the dissertation topic. A student may not achieve candidacy and graduate in the same term. Candidacy must be achieved at least one term prior to the term of graduation.

Dissertation

Students must complete and defend a dissertation based on a research program approved by the student's Dissertation Advisor and Advisory Committee which results in a high-quality, original, and substantial piece of research. Students must be continually enrolled in BDBA 8999 for dissertation research credit, beginning with the semester following completion of the qualifying assessment and continuing through the semester of their graduation. Defense of the dissertation is conducted in a final oral examination that is open to members of the University community. The announcement of the final defense can be uploaded by the advisor to the Graduate School website at least 10 days prior to the date and disseminated through the Academic Affairs listserv. The announcement of the dissertation defense should include identification of the student's full name, the date of the defense, the location of the defense, the time of the defense, the title of the dissertation, the name of the Chair of the dissertation committee, and a brief Abstract of the dissertation. The defense constitutes the final exam for a doctoral student. The decision of the faculty advisory committee is final. In the rare event of a split decision, typically the faculty come to an agreement as to whether the student defense is acceptable. No student is permitted to take the final examination more than twice.

For doctoral students, the committee will consist of at least four Graduate Faculty members, one of whom is appointed by the Dean of the Graduate School as the Graduate Faculty Representative.

The committee for doctoral students is indicated on the Appointment of Doctoral Dissertation Committee form (available in the Graduate School office or online). At the time that the Appointment of Doctoral Dissertation Committee form is approved, the Graduate School appoints the Graduate Faculty Representative to serve on the doctoral committee.

It is expected that all dissertation committee members be present for the dissertation proposal defense and for the dissertation final defense. If there is an exceptional case in which a committee member needs to participate in the proposal or final defense from a remote location, the student and all committee members must assure that all the conditions listed on the Approval of Remote Committee Participation Form are met. This form is available online on the Graduate School website under Current Students and must be completed and returned to the Graduate School at least two weeks prior to the scheduled proposal or final defense.

The dissertation must be submitted for final review by the student's committee at least two weeks before the date of the final examination in which the dissertation is defended. Following the successful completion of this defense, the doctoral candidate must submit one electronic copy of the approved error-free manuscript to the Graduate School (via ProQuest) no later than the filing date indicated in the University calendar. Guidelines for the preparation of the dissertation are online on the Graduate School website under Current Students. Each student must submit the Defense Report for Doctoral Dissertation and/or Master's thesis form, the Submission and ETD Signature form, and the original dissertation title page to the Graduate School (with original signatures).

The Graduate School requires publication of the dissertation through ProQuest, an online database of dissertations. The student is responsible for paying the optional copyrighting fees. Any other arrangements for publications of the dissertation must not interfere with publication through ProQuest. It may be appropriate for some students to restrict access to their dissertation temporarily (such as when a patent application is pending). In these cases, the student and their committee must submit an embargo request to the Graduate School

explaining why restricted access is needed.

As a research university, UNC Charlotte contributes to the scholarly community through the work of faculty and graduate students. Students are required to submit their dissertation or thesis to ProQuest, an online repository for scholarly work. Although the author of the work retains the copyright, open access may impact the likelihood of publication in some journals. More information is available at www.ProQuest.com.

Under certain circumstances, research may need to be temporarily withheld from publications or "embargoed." Such restrictions may be requested when a:

a) patent application is expected;
b) publication has been submitted and the publisher's copyright excludes publication of the work in Proquest. In this case, a screen shot of the journal policy must be included.
c) contract with an outside entity, such as a government agency, requires that the research be embargoed temporarily.

To request an embargo of a dissertation or thesis, the student and the advisor must submit a request to the Graduate School, which will include supporting documentation. Embargoes may be requested for up to one year, after which time the document will be made available through ProQuest. In extraordinary circumstances, an extension to the embargo may be requested.

Graduate Faculty Representative

The graduate faculty representative is a member of the doctoral student's advisory committee appointed by the Graduate School. Advisors may recommend to the Graduate School a faculty member who meets the relevant criteria (below). Recommendations should accompany the initial Committee form. The graduate faculty representative must assure that the doctoral student is treated fairly and impartially by their advisory committee, and assure that University standards and policies are upheld. For these reasons, faculty serving in this role should hold tenure and a Regular Graduate Faculty membership, have served on a dissertation or thesis committee prior to this appointment and come from a department different than the student and chair. This faculty member's role is primarily but not totally procedural. The faculty member may also participate in the development and evaluation of the student's research to the extent appropriate for the faculty member's background. The Graduate Faculty Representative is a full voting member of the committee. This representative is appointed prior to the student's dissertation proposal defense and must participate in the formation of the student's topic and in the final dissertation examination.

Application for Degree

Students who are co-enrolled in a master's and doctoral program should be enrolled in both programs for two academic terms prior to graduation from either degree. Students should submit the Online Graduation Application at the beginning of the term in which they anticipate defending their dissertation. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

ED.D. DEGREE REQUIREMENTS

The Doctor of Education (Ed.D.) degree is conferred by the University after the student has successfully completed all requirements in an approved doctoral program of study in the College of Education. Specific program degree requirements are described in the College of Education section of this *Catalog*.

Program of Study

Although the maximum amount of credit past the master's degree that an Ed.D. student may count towards a doctorate is 9 credit hours, only educational administration courses approved by the program coordinator may be transferred. This rule applies whether the courses were taken at UNC Charlotte or elsewhere; however, no more than six hours taken when the student was in post-baccalaureate (non-degree seeking) status may be applied toward the doctoral degree.

Students are expected to satisfactorily complete all required coursework with a GPA of 3.0 or above in courses on the degree plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the degree plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the

program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Time Limit

All requirements for the Ed.D. must be completed within nine (9) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than nine years may be applied towards a research doctoral degree (including transfer credit). Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Qualifying Assessment

Students are required to successfully pass a written and oral examination. Qualifying assessments are administered by graduate program faculty. The examination is based upon the core areas of educational leadership, educational research, and instructional technology. Students who fail a qualifying assessment are subject to termination and should discuss options with their graduate program director. With program approval, a qualifying assessment may be retaken one time. If the student fails the exam a second time, the program may, in rare circumstance and with compelling evidence, allow a student to, within four months, retake the exam (or portion of the exam). In such case s, the program must document the circumstances under which the student is allowed to retake portions of the exam and demonstrate that the student's committee unanimously supports the decision. Documentation must be submitted to the Graduate School for review prior to the exam date. In no instance will the student be allowed to take the exam (or portion of the exam) a fourth time. Students may only appeal a termination to the Graduate School if their appeal to retake the exam is based on a procedural error or discrimination (please see the Category 2 appeal description under *Appeal for Academic Termination*) and their initial appeal to the program was denied.

Admission to Candidacy Requirements

Students are recommended for admission to candidacy after successfully completing the written and oral comprehensive examination. A student may not achieve candidacy and graduate in the same term. Candidacy must be achieved at least one term prior to the term of graduation.

Dissertation

Students must complete and defend a dissertation focused on a specific problem or question relevant to K-12 or higher education organizations, administration, or leadership. Students must be continually enrolled in ADMN 8999 (3 credit hours; Fall, Spring, and Summer semesters) for dissertation research credit, beginning with the semester following completion of the qualifying assessment and continuing through the semester of their graduation. Defense of the dissertation is conducted in a final oral examination that is open to members of the University community. The announcement of the final defense can be uploaded by the advisor to the Graduate School website at least 10 days prior to the date and disseminated through the Academic Affairs listserv. The announcement of the dissertation defense should include identification of the student's full name, the date of the defense, the location of the defense, the time of the defense, the title of the dissertation, the name of the Chair of the dissertation committee, and a brief Abstract of the dissertation. The defense constitutes the final exam for a doctoral student. The decision of the faculty advisory committee is final. In the rare event of a split decision, typically the faculty come to an agreement as to whether the student defense is acceptable. No student is permitted to take the final examination more than twice.

For doctoral students, the committee will consist of at least four Graduate Faculty members, one of whom is appointed by the Dean of the Graduate School as the Graduate Faculty Representative.

The committee for doctoral students is indicated on the Appointment of Doctoral Dissertation Committee form (available in the Graduate School office or online). At the time that the Appointment of Doctoral Dissertation Committee form is approved, the Graduate School appoints the Graduate Faculty Representative to serve on the doctoral committee.

It is expected that all dissertation committee members be present for the dissertation proposal defense and for the dissertation final defense. If there is an exceptional case in which a committee member needs to participate in the proposal or final defense from a remote location, the student and all committee members must assure that all the conditions listed on the Approval of Remote Committee Participation Form are met. This form is available online on the Graduate School website under Current Students and must be completed and returned to the Graduate School at least two weeks prior to the scheduled proposal or final defense.

The dissertation must be submitted for final review by the student's committee at least two weeks before the date of the final examination in which the dissertation is defended. Following the successful completion of this defense, the doctoral candidate must submit one electronic copy of the approved error-free manuscript to the Graduate School (via ProQuest) no later than the filing date indicated in the University calendar. Guidelines for the preparation of the dissertation are available online on the Graduate School website under Current Students. Each student must submit the Defense Report for Doctoral Dissertation and/or Master's thesis form, the Submission and ETD Signature form, and the original dissertation title page to the Graduate School (with original signatures).

The Graduate School requires publication of the dissertation through ProQuest, an online database of dissertations. The student is responsible for paying the optional copyrighting fees. Any other arrangements for publications of the dissertation must not interfere with publication through ProQuest. It may be appropriate for some students to restrict access to their dissertation temporarily (such as when a patent application is pending). In these cases, the student and their committee must submit an embargo request to the Graduate School explaining why restricted access is needed.

As a research university, UNC Charlotte contributes to the scholarly community through the work of faculty and graduate students. Students are required to submit their dissertation or thesis to ProQuest, an online repository for scholarly work. Although the author of the work retains the copyright, open access may impact the likelihood of publication in some journals. More information is available at www.ProQuest.com.

Under certain circumstances, research may need to be temporarily withheld from publications or "embargoed." Such restrictions may be requested when a:

a) patent application is expected;
b) publication has been submitted and the publisher's copyright excludes publication of the work in Proquest. In this case, a screen shot of the journal policy must be included.
c) contract with an outside entity, such as a government agency, requires that the research be embargoed temporarily.

To request an embargo of a dissertation or thesis, the student and the advisor must submit a request to the Graduate School, which will include supporting documentation. Embargoes may be requested for up to one year, after which time the document will be made available through ProQuest. In extraordinary circumstances, an extension to the embargo may be requested.

Graduate Faculty Representative

The graduate faculty representative is a member of the doctoral student's advisory committee appointed by the Graduate School. Advisors may recommend to the Graduate School a faculty member who meets the relevant criteria (below). Recommendations should accompany the initial Committee form. The graduate faculty representative must assure that the doctoral student is treated fairly and impartially by their advisory committee, and assure that University standards and policies are upheld. For these reasons, faculty serving in this role should hold tenure and a Regular Graduate Faculty membership, have served on a dissertation or thesis committee prior to this appointment and come from a department different than the student and chair. This faculty member's role is primarily but not totally procedural. The faculty member may also participate in the development and evaluation of the student's research to the extent appropriate for the faculty member's background. The Graduate Faculty Representative is a full voting member of the committee. This representative is appointed prior to the student's dissertation proposal defense and must participate in the formation of the student's topic and in the final dissertation examination.

Application for Degree

Students who are co-enrolled in a master's and doctoral program should be enrolled in both programs for two academic terms prior to graduation from either degree. Students should submit the Online Graduation Application at the beginning of the term in which they anticipate defending their dissertation. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

DNP DEGREE REQUIREMENTS

The Doctor of Nursing Practice (DNP) degree is conferred by the University after the student has successfully completed all requirements in an approved doctoral

program of study in the School of Nursing. Specific program degree requirements are described in the College of Health and Human Services section of this *Catalog*.

Program of Study

No more than 6 credit hours will be accepted for transfer into the DNP program. This rule applies whether the courses were taken at UNC Charlotte or elsewhere. Eligibility of courses for transfer is determined jointly by the School of Nursing and the Graduate School.

Students are expected to satisfactorily complete all required coursework with a GPA of 3.0 or above in courses on the degree plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the degree plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Time Limit

All requirements for a professional doctoral degree (DNP) must be completed within six (6) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than six years may be applied towards a professional doctoral degree (including transfer credit). Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Qualifying Assessment

Upon approval of the DNP Scholarly Project topic, the student begins to develop the project. Once the project development is complete, the student presents to the committee the final proposal for the project. The student's DNP Scholarly Project proposal serves as the primary component of the qualifying assessment for the DNP program. Students who fail a qualifying assessment are subject to termination and should discuss options with their graduate program director. With program approval, a qualifying assessment may be retaken one time. If the student fails the assessment a second time, the program may, in rare circumstance and with compelling evidence, allow a student to, within four months, retake the exam (or portion of the exam). In such cases, the program must document the circumstances under which the student is allowed to retake portions of the exam and demonstrate that the student's committee unanimously supports the decision. Documentation must be submitted to the Graduate School for review prior to the exam date. In no instance will the student be allowed to take the exam (or portion of the exam) a fourth time. Students may only appeal a termination to the Graduate School if their appeal to retake the exam is based on a procedural error or discrimination (please see the Category 2 appeal description under *Appeal for Academic Termination*) and their initial appeal to the program was denied.

Admission to Candidacy Requirements

Students are recommended for admission to candidacy after successfully completing the DNP Scholarly Project defense. A student may not achieve candidacy and graduate in the same term. Candidacy must be achieved at least one term prior to the term of graduation.

Scholarly Project

Students complete a DNP Scholarly Project in conjunction with their clinical residency courses. The DNP Scholarly Project is a project that brings together the practice and scholarship aspects of the Doctor of Nursing Practice degree. It is designed to address complex practice issues that affect groups of patients, healthcare organizations, or healthcare systems while utilizing informatics, technology, and in-depth knowledge of the clinical and behavioral sciences. The clinical scholarship required in the DNP Scholarly Project reflects mastery and competency in the student's area of expertise. The DNP Scholarly Project begins in the first semester of study and continues throughout the program, culminating in a scholarly public defense. Defense of the Scholarly Project is conducted in a final oral examination that is open to members of the University community. The announcement of the final defense can be uploaded by the advisor to the Graduate School website at least 10 days prior to the date and disseminated through the Academic Affairs listserv. The announcement of the Scholarly Project defense should include identification of the student's full name, the date of the defense, the location of the defense, the time of the defense, the title of the Scholarly Project, the name of the Chair of the Scholarly Project committee, and a brief Abstract of the dissertation. The defense constitutes the final exam for a doctoral student. The decision of the faculty advisory committee is final. In the rare event of a split decision, typically the faculty come to an agreement

as to whether the student defense is acceptable. No student is permitted to take the final examination more than twice.

The DNP Scholarly Project is guided by the DNP Scholarly Project Committee. The composition of the DNP Scholarly Project committee includes: 1) a chair who is a doctoral prepared faculty member with regular graduate faculty status at UNC Charlotte; 2) an expert clinical mentor (Ph.D., DNP, M.D. or other doctoral prepared individual; 3) one additional faculty member; and 4) a graduate faculty representative appointed by the Graduate School at UNC Charlotte. It is the responsibility of the DNP Scholarly Project Committee to guide the student through project planning, implementation, and evaluation process. The committee for doctoral students is indicated on the Appointment of Doctoral Dissertation Committee form (available online at the Graduate School's website). At the time that the Appointment of Doctoral Dissertation Committee form is approved, the Graduate School appoints the Graduate Faculty Representative to serve on the doctoral committee.

It is expected that all Scholarly Project committee members be present for the Scholarly Project proposal defense and for the final defense. If there is an exceptional case in which a committee member needs to participate in the proposal or final defense from a remote location, the student and all committee members must assure that all the conditions listed on the Approval of Remote Committee Participation Form are met. This form is available online on the Graduate School website under Current Students and must be completed and returned to the Graduate School at least two weeks prior to the scheduled proposal or final defense.

The Scholarly Project must be submitted for final review by the student's committee at least two weeks before the date of the final examination in which the Scholarly Project is defended. Following the successful completion of this defense, the doctoral candidate must submit one electronic copy of the approved error-free manuscript to the Graduate School (via ProQuest) no later than the filing date indicated in the University calendar. Guidelines for the preparation of the scholarly project are online on the Graduate School website under Current Students. Each student must submit the Defense Report for Doctoral Dissertation and/or Master's thesis form and the original dissertation title page to the Graduate School (with original signatures).

The Graduate School requires publication of the Scholarly Project through ProQuest, an online database of dissertations. The student is responsible for paying the optional copyrighting fees. Any other arrangements for publications of the dissertation must not interfere with publication through ProQuest. It may be appropriate for some students to restrict access to their dissertation temporarily (such as when a patent application is pending). In these cases, the student and their committee must submit an embargo request to the Graduate School explaining why restricted access is needed.

As a research university, UNC Charlotte contributes to the scholarly community through the work of faculty and graduate students. Students are required to submit their dissertation or thesis to ProQuest, an online repository for scholarly work. Although the author of the work retains the copyright, open access may impact the likelihood of publication in some journals. More information is available at www.ProQuest.com.

Under certain circumstances, research may need to be temporarily withheld from publications or "embargoed." Such restrictions may be requested when a:

a) patent application is expected;
b) publication has been submitted and the publisher's copyright excludes publication of the work in Proquest. In this case, a screen shot of the journal policy must be included.
c) contract with an outside entity, such as a government agency, requires that the research be embargoed temporarily.

To request an embargo of a dissertation or thesis, the student and the advisor must submit a request to the Graduate School, which will include supporting documentation. Embargoes may be requested for up to one year, after which time the document will be made available through ProQuest. In extraordinary circumstances, an extension to the embargo may be requested.

Graduate Faculty Representative

The graduate faculty representative is a member of the doctoral student's advisory committee appointed by the Graduate School. Advisors may recommend to the Graduate School a faculty member who meets the relevant criteria (below). Recommendations should accompany the initial Committee form. The graduate faculty representative must assure that the doctoral student is treated fairly and impartially by their advisory committee, and assure that University standards and policies are upheld. For these reasons, faculty serving in this role should hold tenure and a Regular Graduate Faculty membership, have served on a scholarly committee prior to this appointment and come from a department different than the student and chair. This faculty member's role is primarily but not totally procedural. The faculty member may also participate in the development and evaluation of the student's research to the extent appropriate for the faculty member's background. The Graduate Faculty Representative is a full

voting member of the committee. This representative is appointed prior to the student's Scholarly Project proposal defense and must participate in the formation of the student's topic and in the final Scholarly Project examination.

Application for Degree

Students should submit the Online Graduation Application at the beginning of the term in which they anticipate defending their dissertation. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their Scholarly Project and file the final copy of the Scholarly Project in the Graduate School. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

GRADUATE CERTIFICATE REQUIREMENTS

The graduate certificate is awarded for successful completion of a coherent program of at least 12 credit hours proposed by a unit of the graduate faculty and approved by the Graduate Council. Students are admitted to a particular graduate certificate program and are advised by faculty in the unit offering the graduate certificate. Admission to a graduate certificate program is separate and distinct from admission to a graduate degree program. Admission to a certificate program is not an indication of subsequent admission to a degree program just as admission to a degree program is not an indication of admission to a certificate program.

Since the graduate certificate is not a degree, students may apply the credits earned in the certificate program toward a single degree that they pursue either in conjunction with the graduate certificate or after the certificate has been awarded. However, students may not apply credits earned in one certificate program toward the satisfaction of requirements in a second certificate program.

Students may enroll in a graduate certificate program only or may complete the certificate in conjunction with a graduate degree program at the University. Hours taken toward a graduate certificate may be counted toward a graduate degree program with the recommendation of the graduate program coordinator and the approval of the Graduate School.

Graduate certificate programs generally require at least 12 credit hours of graduate coursework. Up to six hours taken at post-baccalaureate status at UNC Charlotte may be applied toward a certificate with the recommendation of the program coordinator and the approval of the Graduate School. Students ordinarily may not transfer hours from another institution into a certificate program. The graduate certificate is awarded to a student who has completed the specified program of study with a GPA of 3.0 or above within five years from the time of enrollment in the first certificate course and has applied to graduate.

Students are expected to satisfactorily complete all required coursework with a GPA of 3.0 or above in courses on the certificate plan of study. Grades in all courses attempted, whether or not on the plan of study, remain on the transcript and will be included in the calculation of the student's cumulative GPA as it is reported on the transcript. Courses graded as C on the certificate plan of study must be offset by an equal number of graduate-level credits graded as A. Some programs may have stricter requirements regarding the applicability of grades of C towards degree completion. Please reference the program-specific entries of this *Catalog*. Students and faculty should refer to the Academic Suspension and Termination policies in this *Catalog* regarding the accumulation of marginal grades of C.

Time Limit

All requirements for the graduate certificate must be completed within five (5) calendar years, beginning with the student's first term in the program. The time limit cannot be paused, even if the student takes an approved leave of absence. No course older than five years may be applied towards a graduate certificate. Any course that exceeds this limit must be retaken. Failure to adhere to the time limit may result in the termination of a student's enrollment.

The Graduate School may consider requests for a single extension of one (1) year in cases with rare, extenuating circumstances. In such cases, the student and graduate program must provide a signed timeline for program completion that does not exceed one year. Failure to adhere to the approved timeline for completion will result in automatic termination of the student's enrollment for a lack of satisfactory academic progress. Multiple extensions will not be approved.

Application for Certificate

Students should submit the Online Graduation Application at the beginning of the term in which they anticipate completion of the certificate program. Adherence to Graduate School deadlines is expected. Students are encouraged to review their individual DegreeWorks audit to ensure they have met all graduation requirements.

Students completing their degree and/or certificate requirements in May participate in the May commencement ceremony. Students completing degrees and/or certificates in a summer term, as well as those completing in December, participate in the December commencement ceremony.

Note: No Graduate Certificates will be awarded retroactively.

ACADEMIC RECORDS AND TRANSCRIPTS

The Office of the Registrar is responsible for maintaining the official academic records for all students. Upon request by a student through Banner Self-Service, an official transcript of the academic record will be issued to the person or institution designated, provided that all the student's obligations to the University have been settled satisfactorily. For active students, transcripts can be ordered by logging in to my.charlotte.edu and selecting Banner Self Service. For former students who have been away for more than 12 months, transcripts can be ordered through the University's transcript provider, Parchment Exchange, at parchment.com/u/registration/39530834/institution.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA) NOTIFICATION

A full explanation of FERPA rights and responsibilities at UNC Charlotte is found in the complete text of University Policy 402, Student Education Records (FERPA) at legal.charlotte.edu/policies/up-402, as that policy may be modified from time to time.

I. RIGHTS

In establishing University Policy 402, Student Education Records, UNC Charlotte adheres to a policy of compliance with the Family Educational Rights and Privacy Act of 1974, also known as FERPA, a federal law that affords students the following rights with respect to their education records:

A. To inspect and review the student's education records:

Students should submit to the Office of the Registrar, dean of their college, chair of their major academic department, or other appropriate official written requests that identify the record(s) they wish to inspect. University official will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the University official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.

B. To consent to disclosure of the student's education records to third parties, except to the extent that FERPA authorizes disclosure without consent, as follows:

1. Directory Information. Directory information (as defined in Section I of University Policy 402), including student images and email addresses, may appear in public documents and may otherwise be disclosed without student consent unless a student submits a request form to the Registrar to withhold such information from disclosure. A request for non-disclosure will be honored by the University indefinitely, unless the student submits to the Registrar a written revocation of such request for non-disclosure.

2. University Officials. University officials with legitimate educational interests in the student's education records are allowed access to student education records. A "legitimate educational interest" is defined as an interest that is essential to the general process of higher education, including teaching, research, public service, academic advising, general counseling, discipline, job placement, financial assistance, medical services, and academic assistance activities. University officials who may have access to only those education records in which they have legitimate educational interests include, but are not limited to, personnel in the following offices:

- Undergraduate Admissions
- Graduate Admissions
- Office of University Registrar
- Office of Undergraduate Education
- Financial Aid
- Financial Services
- Auxiliary Services
- Student Employment Office

- University Center for Academic Excellence
- Career Center
- Counseling Center
- Office of Adult Students and Evening Services
- Disability Services
- OneIT, for technical support associated with maintaining student education records only
- Internal Audit
- Office of Enrollment Management
- Office of Director of Athletics
- Office of Vice Chancellor for Student Affairs
- Office of Vice Chancellor for Business Affairs
- Office of Dean of Students
- Office of Dean of Graduate School
- Office of International Programs
- Offices of Chairpersons of Departments
- Offices of Deans of Colleges
- Offices of Directors of Interdisciplinary Units
- Office of Provost
- Office of Chancellor
- Office of Legal Affairs
- Campus Police, for internal law enforcement or health and safety purposes only
- University Advancement
- Teaching and Learning Connection
- Academic counselors and advisors
- Campus Behavioral Intervention Team
- Office of Institutional Research
- Faculty members
- Other academic and administrative personnel, as approved by the Chancellor

3. Parents of Dependents. Parents of a student who is a dependent for federal tax purposes, as defined by Section 152 of the Internal Revenue Code of 1954, may have access to that student's education records without prior consent of the student. Parents may demonstrate the tax dependency of a student only by submitting to the University a copy of the first and signature pages of their most recently filed federal income tax return (with personal financial data removed). Alternatively, a student may demonstrate tax dependency, and thus allow parental access to the student's records without prior consent of the student, by submitting to the University a signed statement of their tax dependency. If a dependent student's parents are divorced, both parents may have access to the student's records, so long as at least one parent claims the student as a dependent.

4. Other Institutions. The University may release a student's education records to officials of another school, school system, or institution of postsecondary education where the student seeks or intends to enroll, or where the student is already enrolled, so long as the disclosure is for purposes related to the student's enrollment or transfer.

5. Financial Aid. The University may release a student's education records to persons or organizations in connection with that student's application for, or receipt of, financial aid, but only to the extent necessary for such purposes as determining eligibility, amount, conditions, and enforcement of terms or conditions of such financial aid.

6. Accreditation Agencies. The University may release students' education records to accreditation organizations or agencies for purposes necessary to carry out their accreditation functions.

7. Judicial Orders. Information concerning a student shall be released in response to a judicial order or lawfully issued subpoena, subject to the conditions set forth in 34 CFR § 99.31(a)(9). The University will make reasonable efforts to notify the student of a subpoena before complying with it, except that the University shall not notify a student of a subpoena if it is from a federal grand jury or is for law enforcement purposes, and it provides that the University shall not disclose to any person the existence or contents of the subpoena or any information furnished in response to the subpoena.

8. Litigation. If the University initiates legal action against a parent or student, or if a parent or student initiates legal action against the University, the University may disclose to the court, without a court order or subpoena, the education records of the student that are relevant for the University to proceed with the legal action as plaintiff or to defend itself in such legal action.

9. Health and Safety. The University may, subject to the conditions set forth in 34 CFR § 99.36, disclose student information to appropriate persons, including parents of a student, in connection with an emergency if knowledge of the information is necessary to protect the health or safety of the student or other individuals.

10. Student Conduct Hearing Results.

a. Disclosure to Victims: The University may disclose to an alleged victim of any crime of violence (as that term is defined in Chapter 1, Section 16 of Title 18, United States Code), or a non-forcible sex offense, the final results of any student conduct proceeding conducted by the University against the alleged perpetrator of such crime or offense with respect to such crime or offense, regardless of whether the alleged perpetrator was found responsible for violating the University's rules or policies with respect

to such crime or offense.

b. Disclosure to Third Parties: The University may disclose the final results of any student conduct proceeding against a student who is an alleged perpetrator of any crime of violence or non-forcible sex offense (as those terms are defined in 34 C.F.R. 99.39), if the student is found responsible on or after October 7, 1998, for violating the University's rules or policies with respect to such crime or offense. Such disclosure shall include only the name of the student, the violation committed, and any sanction imposed by the University on that student. Such disclosure may include the name of any other student, such as a victim or witness, only with the written consent of that other student.

11. Alcohol and Drug Violations. The University may disclose to a parent or legal guardian of a student, information regarding any violation of any Federal, State, or local law, or of any rule or policy of the University, governing the use or possession of alcohol or a controlled substance, regardless of whether that information is contained in the student's education records, if the student is under the age of 21 at the time of disclosure to the parent, and the University determines that the student is responsible for a student conduct violation with respect to such use or possession.

12. Federal, State, and Local Officials and Educational Authorities. Subject to the requirements of 34 CFR § 99.35, the University may disclose education records to authorized representatives of (i) The Comptroller General of the United States; (ii) The Attorney General of the United States; (iii) The Secretary; or (iv) State and local educational authorities.

13. Institutional Studies. The University may disclose education records, but only under the conditions set forth in 34 CFR § 99.31(a)(6), to organizations conducting studies for, or on behalf of, educational agencies or institutions to (A) Develop, validate, or administer predictive tests; (B) Administer student aid programs; or (C) Improve instruction.

14. Contractors. The University may disclose education records to a contractor, consultant, volunteer, or other party to whom the University has outsourced institutional services or functions, provided that the outside party:

- Performs an institutional service or function for which University would otherwise use employees;
- Is under the direct control of the University with respect to the use and maintenance of education records; and
- Is subject to the requirements of Section 99.33(a) governing the use and redisclosure of Personally Identifiable Information from education records.

15. Registered Sex Offenders. The University may disclose education records concerning sex offenders and other individuals required to register under Section 170101 of the Violent Crime Control and Law Enforcement Act of 1994, 42 U.S.C. 14071, if the information was provided to the University under 42 U.S.C. 14071 and applicable Federal guidelines.

C. To request amendment of the student's education records to ensure that they are not inaccurate or misleading:

A student who wishes to ask the University to amend a record should write the University Registrar, clearly identify the part of the record the student wants changed, and specify why it should be changed.

If the University decides not to amend the record as requested, the University will notify the student in writing of the decision and the student's right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

D. To be notified of the student's privacy rights under FERPA, as indicated by this Notification.

E. To file a complaint with the U.S. Department of Education concerning alleged failures by the University to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is:

Family Policy Compliance Office
U.S. Department of Education
400 Maryland Avenue, SW
Washington, DC 20202-8520

II. DEFINITIONS

"Directory Information" means information in a student's education record that would not generally be considered harmful or an invasion of privacy if disclosed. At UNC Charlotte, directory information consists of the student's name, major field of study, dates of attendance, enrollment status, and degrees and awards (including scholarships) received.

Photographs, videos, or other media containing a student's image or likeness (collectively, "student images") and University-issued student electronic mail addresses ("email

addresses") are designated by UNC Charlotte as "Limited Use Directory Information." Use and disclosure of Limited Use Directory Information will be restricted to:

1. publication in official University publications or on social media sites or websites hosted or maintained by, on behalf of, or for the benefit of the University, including the University's online directory and internal email system;
2. University officials who have access, consistent with FERPA, to such information and only in conjunction with a legitimate educational interest; and
3. external parties contractually affiliated with the University, provided such affiliation requires the sharing of Limited Use Directory Information.

In addition, the following shall be considered Limited Use Directory Information that may be disclosed only to other students enrolled in the same course (regardless of whether such students are enrolled in the same class section or break-out group) that has been audio or video recorded by the University, for instructional and educational purposes only:

1. name, to the extent it is referenced or captured during the audio or video recording;
2. any photograph or image of the student captured during the audio or video recording;
3. any audio or video recording of the student participating in the course; and
4. any online chats or other recorded communications among participants in the course captured during the audio or video recording.

A student who requests to withhold this Limited Use Directory Information from disclosure pursuant to Section II.B.1 below may limit the extent to which they will be able to participate in the course.

To protect the privacy of other students, students are not permitted to make their own recordings of class sessions or to share or distribute University recordings of class sessions.

"**Education Records**" include records directly related to a student that are maintained by UNC Charlotte. Education records **do not** include:

1. Records of instructional, administrative, and educational personnel that are in the sole possession of the maker (i.e. file notes of conversations), are used only as a personal memory aid, and are not accessible or revealed to any individual except a temporary substitute;
2. Records of the UNC Charlotte campus police;
3. Student medical and counseling records created, maintained, and used only in connection with provision of medical treatment or counseling to the student, that are not disclosed to anyone other than the individuals providing the treatment. (While a student may not inspect their medical records, these records may be reviewed by a physician of the student's choice);
4. Employment records unrelated to the student's status as a student;
5. Records created or received by an educational agency or institution after an individual is no longer a student in attendance, and that are not directly related to the individual's attendance as a student;
6. Grades on peer-graded papers before they are collected and recorded by a teacher.

"**Personally Identifiable Information**" includes, but is not limited to:

- The student's name;
- The name of the student's parent or other family members;
- The address of the student or student's family;
- A personal identifier, such as the student's social security number, student identification number, or biometric record;
- Other indirect identifiers, such as the student's date of birth, place of birth, and mother's maiden name;
- Other information that, alone or in combination, is linked or linkable to a specific student that would allow a reasonable person in the school community, who does not have personal knowledge of the relevant circumstances, to identify the student with reasonable certainty; or
- Information requested by a person who the University reasonably believes knows the identity of the student to whom the education record relates.

"**Student**" means an individual who is or who has been in attendance at UNC Charlotte. It does not include persons who have been admitted but did not attend the University. For the purposes of this policy, "attendance" includes attendance in person or by paper correspondence, videoconference, satellite, Internet, or other electronic information and telecommunications technologies for students who are not physically present in the classroom; and the period during which a person is working under a UNC Charlotte work-study program.

III. COMPLIANCE

UNC Charlotte intends to comply fully with these requirements. University Policy 402, Student Records,

explains the procedures for compliance. Students may obtain copies of the policy in the Office of the Registrar or online at legal.charlotte.edu/policies/up-402. That policy includes a list of the locations of all education records maintained by the institution.

All questions concerning this FERPA Annual Notification may be directed to the attention of the Office of the Registrar.

Financial Information

ninercentral.charlotte.edu

GRADUATE TUITION AND FEES

UNC Charlotte is a publicly supported institution and primarily receives its revenue from the State of NC appropriations, in addition to tuition and fees. It is the combination of tuition and fees that primarily supports the operations and expansion of UNC Charlotte. Tuition and fees are approved by the Student Representatives, UNC Charlotte Board of Trustees, and the UNC Board of Governors. Tuition rates are also approved by the NC General Assembly. These fees are mandatory to every student and cannot be waived.

Tuition and fees are billed by credit hour for Fall, Spring, and Summer terms. 12 or more credit hours are considered full-time for undergraduate students, and 9 or more credit hours are considered full-time for graduate students.

Charges for tuition and fees vary according to the student's status as a resident or non-resident of North Carolina. A non-resident student pays a higher rate of tuition than a legal resident. For more details, see the heading for *Residence Status for Tuition Purposes* later in this section.

Following are tuition and required fees for 2022-2023. For a complete list, visit ninercentral.charlotte.edu.

GRADUATE TUITION AND FEES PER SEMESTER			
	1-5 Credit Hours	6-8 Credit Hours	9+ Credit Hours
NC Resident Tuition (in-state)	$240.94 per credit hour	$240.94 per credit hour	$2168.50
Non-NC Resident Tuition (out-of-state)	$1026.78 per credit hour	$1026.78 per credit hour	$9241.00
Ed & Tech Fee	129.50	207.25	311.00
Food Service Facility Fee	10.00	10.00	10.00
University Fee	457.00	731.25	1097.00
49er Card Access Fee	7.50	7.50	7.50
Health Services Fee	111.75	167.50	167.50
Safety & Security Fee	12.50	20.00	30.00
Transportation Services Fee	77.50	77.50	77.50
UNC System Association Fee	0.15	0.25	0.50

GRADUATE EXAMPLE TOTALS PER SEMESTER			
	3 Credit Hours	6 Credit Hours	9 Credit Hours
Resident Total Tuition & Fees (in-state)	$1528.73	$2666.927	$3869.50
Non- Resident Total Tuition & Fees (out-of-state)	$3886.23	$7381.92	$10942.00

Graduate Tuition Increment

In addition to the tuition listed above, there is an additional per term charge that is assessed to all students in specific graduate programs. See the Niner Central website at ninercentral.charlotte.edu/billing-payments-refunds/tuition-and-fees/graduate-tuition-fees for a list of applicable graduate programs and the cost of the increment.

The University reserves the right, with the approval of proper authorities, to make changes in tuition and fees at any time. The University also reserves the right to correct any clerical errors on a student's account. For the most current listing of tuition and fees at The University of North Carolina at Charlotte, see ninercentral.charlotte.edu.

Residence Status for Tuition Purposes

Tuition charges are based upon classification of a student as a resident or a non-resident of North Carolina for tuition purposes. The North Carolina Residency Determination Service (RDS), the sole authority for residency determinations, shall determine whether a student is a resident or non-resident for tuition purposes.

Residency Application Procedure

A new, incoming, or current student who wishes to request a residency classification will apply using the Residency Determination Service (RDS). RDS is the entity responsible for all new classifications of residency in North Carolina. To begin the process, visit www.NCresidency.org. ALL student inquiries about initial determinations, reconsiderations, or appeals, should be directed to RDS. Students may contact RDS at 844-319-3640 or rdsinfo@ncresidency.org.

Appeal Procedure

A new, incoming, or current student who has exhausted the residency application procedure and has been classified as a non-resident for tuition purposes, may request further consideration of that decision to the Residency Determination Service (RDS). RDS is the entity responsible for all classifications of residency in North Carolina. ALL student inquiries about initial determinations, reconsiderations or appeals, should be directed to RDS. Students may contact RDS at 844-319-3640 or rdsinfo@ncresidency.org.

Required Fees

The required fees included in the Tuition and Fees table above are explained below.

49er Card Access Fee

This fee supports the University's 49er Card operations and support. The ID card is not only used for identification purposes, but also as a library card and as a campus card for dining and vending purchases. This fee does not cover a replacement card of a lost or stolen card.

Ed and Tech Fee

This fee is directly related to the infrastructure supporting student technology needs across campus including hardware and software applications, supplies for educational materials, web services, laboratory expenses and equipment, public student computing labs, central email and Internet services, training classes and classrooms, and central help desk services.

Food Service Facilities Fee

This fee provides funds to support year round access, maintenance, repairs, and operation of campus dining facilities.

Health Services Fee

This fee funds health and counseling services for students, which includes the operations of the Student Health Center, the Center for Counseling and Psychological Services, and the Center for Wellness Promotion.

Safety and Security Fee

This fee provides funding for several of the recommendations made by the UNC Board of Governors' 2013-14 UNC [system-wide] Campus Security Initiative report which include, but are not limited to: (1) campus police officer and telecommunicator compensation; (2) highly qualified and trained investigators and hearing officers for reports of serious offenses, such as sexual violence; (3) Title IX and Clery Act compliance coordination; (4) substance abuse counselors, case managers, and/or other counseling staff; and (5) system-level safety and security training, coordination, and audit functions. The fee may also provide funding to meet some additional campus-specific safety and security needs consistent with the report's recommendations. The structure for this fee allows $26 of the $30 collected from each student per academic year to fund campus level and shared-services activities, while $4 of the $30 is allocated by the UNC General Administration for system-wide coordination, trainings, and other shared services functions.

Transportation Service Fee

This charge supports funding for Niner Transit (campus

shuttle system), the Niner Paratransit service, and the CATS Access Pass. The services provide UNC Charlotte with efficient and safe campus transportation, reduce vehicular congestion, and decrease the demand for proximity parking.

UNC System Student Association Fee

This fee is a University of NC system-wide fee charged to all system students to support the University Of North Carolina Association of Student Governments. This association is a student led advocacy group whose main purpose is to ensure that the benefits of the University of North Carolina are extended to the people of North Carolina, as far as practicable, free of expense.

University Fee

This is a consolidated fee that relates to University debt service payments (to construct new facilities and purchase administrative computing systems) and to support other activities/operations including Athletics programs and events, Student Activity Center operations, and Cone University Center operations. The following fees are consolidated into the University Fee:

- *Athletics* - Funds intercollegiate athletics, including salaries and maintenance and operation of athletic facilities.
- *Student Activities* - Funds non-academic student services (student unions, intramural facilities, student organizations, newspapers, yearbooks, and entertainment programs).
- *Debt Service* - Funds the principal and interest for capital projects. Examples for UNC Charlotte include the Student Union, Football Stadium, and Student Activity Facility.

Special Fees

The following additional course fees are charged to cover the cost of supplies or special materials:

ADDITIONAL COURSE FEES FOR GRADUATE STUDENTS *(PER SEMESTER)*	
Course	Fee
GRAD 7999 - Certificate/Master's Graduate Residency (Resident)	$240.94
GRAD 7999 - Certificate/Master's Graduate Residency (Non-Resident)	$1026.70
GRAD 9999 - Doctoral Graduate Residency (Resident)	$240.94
GRAD 9999 - Doctoral Graduate Residency (Non-Resident)	$1026.70

Application Fee

A $75 application fee must be submitted with the application for admission. The fee is nondeductible and nonrefundable.

Credit by Examination Fee

A written examination for a course requires a fee of $15. A laboratory examination requiring the arrangement of such things as laboratory materials will require a fee of $25. A combination of a laboratory and written examination will require a fee of $30.

Matriculation Fee

Instead of paying separate fees for such things as new student convocation, commencement, and hardcopy academic transcripts, UNC Charlotte students pay a matriculation fee and receive these and other services at no charge. Students are charged the $150 matriculation fee upon entry into a baccalaureate, graduate certificate/master's, and doctoral program at UNC Charlotte.

DINING, HOUSING, AND PARKING

Dining and Meal Plans

Meal Plans, the 49er Account, and the Optional Dining Account all reside on the UNC Charlotte 49er ID Card.

For a listing of available dining locations, menus, Meal Plans, and Meal Plans Policies, visit aux.charlotte.edu/dining/meal-plans.

Housing

Semester rates for housing at UNC Charlotte. Rates include rent, utilities (including internet, cable, and laundry) and membership in the Resident Students Association (RSA). Prices and plans are subject to change. Housing types are based on availability. Current pricing can be found online at housing.charlotte.edu/apply/rates.

Admission to UNC Charlotte does not guarantee residence hall space. Arrangements for on-campus housing are made, after admission, with the Office of Housing and Residence Life. Shared Residence Hall space is not available to spouses or children of enrolled students.

Housing Deposit

A $200 deposit must be submitted with all housing contracts. The deposit is not applied toward payment of fees. It is refunded only after the student has left on-campus housing and only if the student has met all financial obligations to the University. In the case of contract cancellation, the date of receipt of the written request for cancellation will determine, in part, the student's financial obligation to the University (please see the Housing Contract for the current academic year for specific terms and cancellation dates).

Parking

Students attending UNC Charlotte (and faculty and staff) are required to register their motor vehicle(s) in order to park on campus. Vehicle registration and virtual permit purchase is available online. **Virtual permits are required at all times when parked on campus, unless parked in a visitor parking area.** For students, two categories of virtual permits are issued: *Resident*, for students living on-campus, and *Commuter*, for students living off-campus.

The 2022-2023 annual rate for a resident or full-time commuter student is $480. **Please see pats.charlotte.edu for a complete list of fees, permit information, and where each type of permit allows you to park.** Full-time virtual permits are valid from August 1 of one year through August 14 of the following year. Semester permits are available for those graduating in December or wish to only purchase one semester at a time.

Parking permits are available to purchase for the fall semester only or the full academic year. Discount remote lot and night permits are also available to commuters. Night permits are valid only after 3 p.m. Parking before 3 p.m. requires parking and payment in a visitor space.

The primary factor that determines permit prices is the cost of new deck construction and replacing flat lots with decks. Neither tuition dollars nor state funds are used toward parking facilities; therefore, parking fees must pay for construction and maintenance of all decks, lots, and associated operations.

Penalties for Parking Violations

- Parking and Traffic regulations are enforced 24 hours a day, seven days a week. Currently, permits are enforced at all times, and meters are enforced from 5 a.m. on Monday through 10 p.m. on Friday.
- Violators of University parking regulations are subject to penalties ranging from $20 to $480, depending on the severity of the violation.
- If a citation is not paid or appealed within ten (10) business days, the penalty will be applied to the student's University account. Subsequent registration may be withheld for non-payment.
- Copies of parking regulations and the citation penalty list are posted on the PaTS website.

The Parking and Transportation Services website, pats.charlotte.edu, has current UNC Charlotte parking ordinances, parking policy information, virtual permit and citation FAQs. It is also a source for transportation information, updates, and changes or disruptions to campus parking and transportation.

Questions concerning parking on campus should be directed to Parking and Transportation Services Communications Center at 704-687-0161; open 24 hours weekdays, 5 a.m. Monday through 10 p.m. Friday, except on holidays when the University is closed. Office hours are 8 a.m. to 5 p.m., Monday-Friday. Emergency situations and questions at other times should be directed to the Campus Police at 704-687-2200.

FUNDING A GRADUATE EDUCATION

Graduate School Funding

Financial support for UNC Charlotte graduate students is provided in the form of fellowships, tuition awards, and assistantships. The majority of full-time enrolled Ph.D. students receive funding, and approximately 15% of master's and certificate students receive some form of funding. Domestic students may also receive some type of federal financial aid to support their studies while enrolled at least half-time (see Financial Aid Programs below).

Nominations for funding are made by the Graduate Program Director, so students should communicate with the Director about the availability of funding support. While some programs provide all or the majority of their students with a graduate assistantship, others provide only limited support.

Graduate Assistant Support Plan (GASP)

The Graduate Assistant Support Plan (GASP) is a competitive multi-year support package used to attract and retain top quality doctoral students to UNC Charlotte. Students enrolled in this plan are eligible to receive full payment of in-state tuition, non-resident tuition (if required), and money for the student health insurance plan. To be eligible, a student must be a doctoral student who holds a graduate assistantship or appropriate fellowship meeting the minimum stipend and must be enrolled full-time (at

least 9 credit hours, GRAD 9800 or GRAD 9999) for the first eight terms of support. In the final academic year of eligibility, GASP will pay for 3 credit hours of GRAD 9800. Students must be nominated by their Graduate Program Director and approved for the award by the Graduate School.

Graduate School Grants

The Graduate School provides partial tuition support to students in master's programs via Graduate School Grants. Graduate School Grants are $3,000/academic year and are awarded to master's students on an annual basis and upon recommendation of the Graduate Program Director and approval of the Graduate School. Students can be enrolled in 3 or more credit hours to be eligible.

Grant Assistance (TAG)

The Tuition Assistance Grant is administered by the Office of Student Financial Aid and the Graduate School. It provides up to $2,000 in grant assistance to students demonstrating financial need regardless of state residency. Eligible students are awarded these grants until funds are exhausted. Generally, these awards are made to eligible students upon nomination for funding for other Graduate School awards.

Assistantships and Employment

The majority of graduate assistantships at UNC Charlotte are awarded by academic departments. Many graduate students seek teaching or research assistantships as a way of both gaining valuable experience and securing financial support. Students may also choose from a variety of on- or off-campus employment opportunities in the Charlotte region, and are also frequently hired as student temporary employees for administrative work on campus.

Student temporary jobs are listed on Hire-A-Niner at hireaniner.charlotte.edu.

Graduate Assistantships

With graduate assistantships, students can gain valuable knowledge and experience related to their degree program by fulfilling teaching and research roles within the University. Stipends, responsibilities, selection criteria, and application and notification procedures vary from department to department, so students should contact their Graduate Program Director for additional information on available assistantships.

Graduate Students may be assigned as Teaching Assistants (TAs), however, only graduate students with at least 18 credit hours in the discipline may serve as a primary instructor of record (IORs).

On-Campus Employment

The Office of Student Employment assists students in obtaining Federal Work Study and temporary student worker positions within the University. Visit the Human Resources website at hr.charlotte.edu/students for more information.

Off-Campus Employment

The University Career Center (UCC) operates a database called Hire-A-Niner, which offers part-time and full-time employment opportunities. Detailed information about the services offered within the UCC can be found on their website at career.charlotte.edu.

Financial Aid Programs

The Office of Student Financial Aid administers several federal, state, and institutional financial aid programs available to graduate students at UNC Charlotte who complete a Free Application for Federal Student Aid (FAFSA). The FAFSA helps U.S. citizens and eligible non-citizens gain access to gift aid (repayment not required) such as grants or self-help aid (direct repayment or service required), like loans and Federal Work Study awards.

Applying for Federal and State Aid

The FAFSA can be completed from the Office of Student Financial Aid website, or directly at www.fafsa.ed.gov. The federal school code for UNC Charlotte is 002975.

Deadlines

The Office of Student Financial Aid must receive completed FAFSA forms by January 1 for grant assistance consideration for the following academic year. For loan assistance, there is no deadline, provided that the FAFSA is received by the Financial Aid Office to allow sufficient processing time prior to the end of the academic year (usually three to four weeks).

Forgivable Education Loans for Service (FELS)

The Forgivable Education Leans for Service Program was established by the North Carolina Assembly to provide assistance to qualified students who are committed to working in North Carolina in designated critical employment shortage professions. For information on deadlines, eligibility, value, and application procedure, visit www.cfnc.org/FELS.

Loan Assistance

Graduate students may borrow up to the maximum loan limit annually from the Federal Direct Stafford Loan Program. That amount is $30,500. Unlike loans for undergraduate students, only Unsubsidized Stafford loans are available to graduate students. "Unsubsidized" means that interest will begin to accrue on the loan once it is

disbursed to the student's account. Students have the option of either paying the interest while enrolled in school at least half-time (5 credit hours for graduate students) or having the interest added to the loan principal. For summer enrollment, three hours counts as half-time. Loan repayment begins six months after the student graduates or ceases to be enrolled at least half-time.

In addition to Stafford Loans, graduate students may borrow funds through the federal Graduate PLUS loan program. Each student's maximum loan amount (combining all loan sources) is limited to the student's total Cost of Attendance minus any other aid received. More detailed information on the Cost of Attendance can be found on the Niner Central website at ninercentral.charlotte.edu.

Private Loans

Loans are also available for domestic and international students through private lenders. Visit the Niner Central website at ninercentral.charlotte.edu to view and compare a list of alternative loan lenders.

Donor-Funded Fellowships and Scholarships

UNC Charlotte provides graduate students the opportunity to apply for scholarships. Scholarships can be merit-based or need-based, and may also focus on other criteria defined by the individual donor or donors who fund the award. Scholarships can be used to offset tuition, room and board, books, or study abroad experiences, and do not have to be repaid.

NinerScholars Portal

The NinerScholars Portal serves as the common application system for all scholarships offered by a college, department, office, or program at UNC Charlotte. NinerScholars uses the University's student information system to build a scholarship profile specific to each student's academic history and current status. The Portal then compares a student's profile to the criteria for each UNC Charlotte scholarship, matches them with those scholarships they are eligible for, and provides the student with the ability to apply for multiple opportunities with a student's uploaded documents.

The NinerScholars Portal gives students direct access to apply to more than 1,000 scholarship opportunities with one application, through one online system. To access the NinerScholars Portal, learn more about specific scholarship opportunities, or take advantage of additional scholarship resources, visit the University Scholarship Office website at scholarships.charlotte.edu.

Graduate School Donor Fellowships and Scholarships

The Graduate School manages several annual fellowships awarded to new and continuing graduate students. Most awards are made in late March. These include:

- Dr. Craig R. Brown Graduate Fellowship (Master's or Doctoral)
- DRReaM Graduate Fellowship (Master's or Doctoral)
- Faye Jacques Memorial Graduate Fellowship (Master's or Doctoral)
- Herschel and Cornelia Everett First-Year Graduate Fellowship (Master's and Doctoral)
- Joanna R. Baker Memorial Graduate Fellowship (Master's or Doctoral)
- John Paul Lucas, Jr. Scholarship for Educational Leadership (Master's)
- Lucille and Edward C. Giles Dissertation-Year Graduate Fellowship (Doctoral)
- Thomas L. Reynolds Graduate Student Research Award (Master's or Doctoral)
- Wayland H. Cato Jr. First-Year Doctoral Fellowship (Doctoral)
- William F. Kennedy Scholarship (Doctoral)
- Zonta Club Scholarship (Master's or Doctoral)

Most of these awards are offered through the University Scholarship Office Awards portal. Details such as criteria and award amount are available in the portal. Visit scholarships.charlotte.edu for details.

External Funding

Many organizations outside of the Graduate School and the University offer fellowships and other funding opportunities to students at all levels of graduate education as part of local, national, and international competitions. UNC Charlotte provides students with access to PIVOT, a comprehensive database of funding opportunities. For more information, visit graduateschool.charlotte.edu/funding/funding-graduate-education.

PAYMENT

The Office of the Bursar bills students for tuition, room and board, and various other University charges. Students with a balance receive an email to their UNC Charlotte email address informing them that their bill is available online at my.charlotte.edu. It is the student's responsibility to regularly check their UNC Charlotte email account. Failure to receive a billing statement or view their account online will not exempt students from having their registration

canceled for non-payment or from having a hold placed on their account blocking them from receiving their transcript and diploma.

Payment can be made by cash, check, online from a checking or savings account (eCheck), or by credit card (Visa, MasterCard, American Express, or Discover). All payments must be in U.S. currency. Remittance should be made payable to "UNC Charlotte" and identified with the student name and ID number.

UNC Charlotte offers a payment plan which allows students to spread out their tuition and fees, on-campus housing and dining, and other charges billed to the student's account into multiple installment payments.

Returned Check Policy

If a check is returned by the bank, students are notified via their UNC Charlotte email account, indicating that a penalty of $35 has been assessed to their student account. A hold is placed on the student's record until the returned check is covered and the penalty is paid.

A student who pays a previous balance with a check in order to have a registration hold flag lifted will have their registration canceled if the check is returned by the bank for any reason.

Parent Information/Authorized Payers

Authorized Payers are family and friends that have been given the ability to access the Student Account information ONLY. In compliance with the Family Educational Rights and Privacy Act of 1974 (FERPA), student financial records may not be shared with a third party without the student's written consent. Adding an authorized payer is the student's written consent that an individual may view their account information and make payments on their behalf. Please note that authorized payers DO NOT have access to a student's stored payment methods, academic records, or other personal information.

Students can add Authorized Payers by logging in to my.charlotte.edu and then clicking the "View or Add Authorized Payer" button located in the My Student Account block.

Authorized Payers will receive an email informing them that they have been granted access to the student's account information. The email notification will include access information that will be used when accessing the information from the Payment/Billing Suite at https://ecom.uncc.edu/C21561_tsa/web/login.jsp.

REFUNDS

Fall and Spring Semesters

Students who officially withdraw (drop all courses) from the University during the Fall or Spring semester will receive a refund as follows:

TUITION AND FEES REFUNDS	
Period of Withdrawal	Percent of Tuition and Fees Refunded
Before last day to Add/Drop course(s) with no grade	100%
Period 1*	90%
Period 2*	50%
Period 3*	25%
Period 4*	0%

**Generally, each period is two weeks in length; however, for specific dates of each period, please visit the Refunds Schedule on the Niner Central website at ninercentral.charlotte.edu/billing-payments-refunds/refunds-reductions-hours/refunds-withdrawal.*

Summer Terms

Students who officially withdraw (drop all courses) from the University during a Summer term will receive a refund as follows:

TUITION AND FEES REFUNDS	
Period of Withdrawal (Summer Terms)	Percent of Tuition and Fees Refunded
Period 1*	100%
Period 2	0%

**Generally, the first period is very short due to the condensed Summer terms; however, for specific dates of each period, please visit the Refunds Schedule on the Niner Central website at ninercentral.charlotte.edu/billing-payments-refunds/refunds-reductions-hours/refunds-withdrawal.*

Exceptions

Charges are refundable by administrative action on a prorated basis for the unexpired portion of the term for the following reasons: death of the student, withdrawal for adequate medical reason as certified by the University's Student Health Center or family doctor, death in the immediate family that necessitates student withdrawal, and dismissal or suspension from school. Immediate family is defined as wife, husband, parent, child, brother, sister, grandparent, and grandchildren, and includes step-, half- and in-law relationships. Appropriate documentation must be submitted to the Dean of Students.

Appeal Procedure for Refunds

Students are provided an opportunity to appeal charges associated with tuition, fees, housing, and dining. The student will have the burden of proving a case for appeal by a preponderance of evidence. Appeals will not be considered that arise from a student's error on registration or situations resulting from a deliberate decision or series of decisions by the student, such as a failure to be aware of deadlines and/or due dates. Full reductions or refunds are typically not granted for students who attend any portion of a semester. Appeals must be substantiated with supporting documentation or verification of extenuating circumstances that warrant basis for the appeal. Extenuating circumstances may include personal or family emergencies as a result of the illness or death of a family member, medical and/or mental health reasons, orders requiring military service, or errors committed by the University. At both levels of appeal, review and consideration for a decision will be based upon the information provided in the appeal as well as the supporting documentation accompanying the appeal. ***Appeals submitted without supporting documentation will not be processed for review and consideration until supporting documentation is provided. Students must submit a first level appeal within one calendar year from the date the fee was initially charged to the student. The second level of appeal must be submitted within ten (10) business days of the delivery of the first appeal decision.*** See thd.charlotte.edu for more details.

College of Arts + Architecture

coaa.charlotte.edu

The College of Arts + Architecture consists of one school and four departments (the School of Architecture and the Departments of Art and Art History, Dance, Music, and Theatre), which share basic educational values and academic aspirations. At the graduate level, the College offers master's programs in architecture and urban design, a graduate certificate in music, and a North Carolina K-12 teacher licensure graduate certificate program in Art Education (*see the College of Education section in this Catalog for details*).

The primary mission of the College is to provide programs that prepare graduates for careers as architects, urban designers, artists, musicians, leaders, cultural administrators, and innovators in our emerging creative economy. The College draws together in a single academic unit disciplines with common histories, methods of inquiry, and potential for contributions to the community. It serves to enhance creative, professional, and cultural production within UNC Charlotte and to help lead the creative economy in the region and state. The College is responsive to both cross-cultural exchange and interdisciplinary research and programming and seeks to provide new connections to the public realm and new opportunities for community leadership.

ARCHITECTURE

- Master of Architecture
- Master of Science in Architecture
  - Design Computation
  - Design Science and Building Systems
- Master of Urban Design
- Master of Architecture and Urban Design Dual Degree
- Master of Architecture and Master of Science in Information Technology Dual Degree
- Master of Science in Architecture and Master of Science in Information Technology Dual Degree

School of Architecture

architecture.charlotte.edu

The School of Architecture at UNC Charlotte offers a fully accredited program recognized for the outstanding quality of its faculty and students, its commitment to outreach and community involvement, and the quality and extent of

resources offered through its labs, classrooms, and studios. Students organize their study around concentrations in Urbanism, Technology, or Design, Theory & Practice. Each area of study is well supported not only by coursework but also by travel and research opportunities. The College participates in several international exchange programs and offers summer travel and study programs in Spain, Italy, Canada, Australia, Great Britain, and China to broaden students' global understanding and further inform their work. The specialized study of urban design is also focused under the auspices of either a separate but interrelated graduate program in that discipline or a dual degree program that combines the two-year Master of Architecture program with graduate study in Urban Design. The Urban Design Program is based in UNC Charlotte's Center City Building in the heart of Uptown Charlotte.

Each curricular program offers each student significant individual time and attention, an engaged and accessible faculty, and a wealth of diversity through both the interests of the faculty and the varied background of the graduate students themselves. Because the School stresses the importance of 'making' in addition to thinking, the wood, metal, computer, and digital fabrication workshops are all equipped with the latest high performance equipment to enable students to both explore and embody their design ideas. Contact with the profession is also emphasized and the School is frequently enriched by the expertise of local practitioners. An extensive lecture series involving nationally and internationally recognized designers and theorists further enhances the educational environment and exposure to contemporary schools of thought.

Program Accreditation

The School of Architecture maintains accredited status through the National Architectural Accrediting Board, which reviews the curriculum, facility, faculty, and program resources annually. In addition, the NAAB conducts an intensive site visit every six years. The School has maintained full accreditation standards as prescribed by this board and includes the following required statement:

> *"In the United States, most registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit professional degree programs in architecture offered by institutions with U.S. regional accreditation, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted an eight-year, three-year, or two-year term of accreditation, depending on the extent of its conformance with established educational standards.*
>
> *Doctor of Architecture and Master of Architecture degree programs may require a preprofessional undergraduate degree in architecture for admission. However, the preprofessional degree is not, by itself, recognized as an accredited degree."*

University of North Carolina at Charlotte, School of Architecture, offers the following NAAB-accredited degree programs:

- B.Arch. (158 undergraduate credit hours)
- M.Arch. (preprofessional degree + 60 graduate credit hours)
- M.Arch. (non-preprofessional degree + 96 credit hours)

Master of Architecture

The professional Master of Architecture degree (M.Arch.) is comprised of three tracks: the M.Arch. I (96 credit hours / 3-1/2 years), M.Arch. II (60 credit hours / 2 years), and M.Arch. A.S. (Advanced Standing) (40 credit hours / 1-1/2 years) tracks. Full-time academic status is expected in all programs.

Each curricular program offers full use of the School's facilities and labs, a close working relationship with accessible faculty and staff, and a wealth of knowledge and backgrounds given the diverse interests of the graduate student population. The School stresses the importance of making in addition to theoretical discourse; hence students have full use of wood, metal, computer, and digifab workshops; equipped with the latest equipment to allow research, exploration, and innovation.

Contact with the profession is also emphasized, and the School maintains various programs and visits from local and national practitioners. An extensive lecture series involving recognized designers and thinkers further enhances the educational environment as well as provides exposure to contemporary issues. The School is one of the first NAAB and NCARB approved programs to offer the Integrated Path to Architectural Licensure (iPAL) pathway to its graduate students.

Graduate study in the School of Architecture includes not only on-campus coursework, but also travel and research opportunities. Many studios take field trips during the semester to learn from regional and national cities, such as New York, Chicago, Seattle, Dallas, and Los Angeles. The School of Architecture also participates in several international exchange programs and has offered summer travel and study programs in Italy, Central Europe, Japan, China, and elsewhere to broaden students' global understanding to further inform their academic experience.

M.Arch Options

The M.Arch. is a NAAB-accredited program that prepares students for professional practice and other career paths in architecture. There are three points of entry to the M.Arch. program based on a student's previous degree, including the M.Arch I, M.Arch. II, and M.Arch. A.S. (Advanced Standing). Prospective students should indicate to which track they are applying in their application.

M.Arch. I

The three and a half year M.Arch. I curriculum is open to students whose previous degree is outside the field of architecture. The M.Arch. I curriculum involves three primary components: 1) the first year (including a summer session that follows the first year) focuses on establishing a strong foundation in fundamental design skills, architectural history and theory, building-to-site relationships, and introductory building and computational technologies; 2) the second year focuses on advanced and topical design issues and their relationship to building systems as well as advanced studies in history, theory, and building technology; and 3) the third year emphasizes integrated design, professional practice, and electives. The concluding experience incorporates a design research diploma project.

M.Arch. II

The two-year M.Arch. II curriculum serves students who have already completed a four-year degree program in architecture at a National Architectural Accrediting Board (NAAB) accredited institution. The courses and options within M.Arch. I and M.Arch. II are similar, but the prior education in an NAAB program for M.Arch. II students allows the completion of the degree in two years.

The M.Arch. II curriculum is tailored through the advising process to the previous educational background of the students and to their individual professional and research goals. The program involves two primary components: 1) the first year focuses on advanced building design and topical design studios, as well as advanced studies in history, theory, computation, and building technologies; and 2) the second year focuses on building design integration, specialization through electives, and a final design research diploma project.

M.Arch. A.S.

The M.Arch. A.S. (Advanced Standing) curriculum at UNC Charlotte is designed for School of Architecture undergraduate degree holders who have established a strong record of academic achievement in their four years of study. The track is earned in three semesters (40 credit hours) and, paired with the UNC Charlotte B.A. in Architecture degree, designed to meet National Architectural Accrediting Board (NAAB) accredited standards.

The program involves two primary components: 1) an intensive first semester summer program that acts as a threshold to graduate level inquiry, and 2) a final year that focuses on building design integration, specialization through electives, and a final design research diploma project.

Dual Degree Options

Students in the M.Arch II or A.S. tracks, and occasionally in the M.Arch I track, may wish to combine their professional architecture studies with graduate work in other programs. These dual degrees typically add a calendar year to student's course of study.

Options include the M.Arch/MSIT Dual Degree, with a research-based specialization in computational design, and the M.Arch./M.U.D Dual Degree, for a specialization in urban design. The M.U.D program includes one summer with a required study abroad experience and is housed off the main campus in the Dubois Center at UNC Charlotte Center City.

Admission Requirements

The following requirements are expected of applicants to the M.Arch. program:

- A minimum undergraduate GPA of 3.0.
- All UNC Charlotte Graduate School application requirements, including a statement of purpose of objectives relative to graduate study in architecture, a current curriculum vitae (CV), transcripts from all other colleges and universities attended, GRE scores (where applicable), and three letters of recommendation.
- School of Architecture application requirements, including a digital portfolio of creative work. Applicants to the M.Arch. I curriculum should submit examples of work that offer evidence of creativity, self-motivation, analysis, and critical thinking. Such examples are not expected to be architectural in nature. Visual work such as painting, sculpture, furniture making, photography, etc., are acceptable, as are fiction writing, poetry, and any other reasonable evidence of sustained creative endeavor. Applicants to the M.Arch. II curriculum should offer significant evidence of a mastery of architectural skill and knowledge as well as other creative work.
- Applicants interested in pursuing a dual degree must simultaneously submit a separate applications to the M.U.D. or M.S.I.T. program and meet the admissions requirements for those programs.
- Applicants to the M.Arch. I curriculum are expected to have completed introductory, college-level physics and pre-calculus courses.
- Applicants to the M.Arch. II curriculum are expected to have a minimum of six semesters of architectural

design studios, two semesters of architectural history/theory, and four semesters of architectural technology equivalent to the following UNC Charlotte's School of Architecture courses:

ARCH 5301 - Materials and Assembly Principles (3)
ARCH 5302 - Environmental Systems Principles (3)
ARCH 5303 - Structural Principles (3)
ARCH 5304 - Structural Systems (3)

Automatic Recommendation for Admissions for M.Arch II or A.S.

The School of Architecture Graduate Admissions Committee will automatically endorse applications from UNC Charlotte four-year Bachelor of Arts in Architecture degree holders with a GPA of 3.5 or above for courses in the major for acceptance to the M.Arch. A.S or M.Arch II programs. UNC Charlotte B.A. in Architecture students with a GPA of 3.5 do not need to submit the full School of Architecture application; however, must still apply to and be accepted by the UNC Charlotte Graduate School.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. For more information about Early Entry Programs, see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog*.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Master of Architecture I Curriculum

The M.Arch. I curriculum requires a minimum of 96 credit hours to be completed during three academic years and one summer session. The curriculum is offered for those having a undergraduate degree in other disciplines that are outside of architectural design.

Year One

Fall (15 credit hours)
ARCH 5201 - Architectural History I: Prehistory-1750 (3)
ARCH 5301 - Material and Assembly Principles (3)
ARCH 6101 - Design Studio: Fundamentals (6)
ARCH 6602 - Representation I: Fundamentals (3)

Spring (15 credit hours)
ARCH 5202 - Architectural History II: 1750-Present (3)
ARCH 5302 - Environmental Systems Principles (3)
ARCH 6102 - Design Studio: Fundamentals (6)
ARCH 6603 - Representation II: Digital Fundamentals (3)

Summer (6 credit hours)
ARCH 6103 - Design Studio: Basics (6)

Year Two

Fall (15 credit hours)
ARCH 5203 - Architectural History III: Survey of Contemporary Theory (1950-Present) (3)
ARCH 5303 - Structural Principles (3)
ARCH 5604 - Computational Methods (3)
ARCH 7101 - Design Studio: Topical (6)

Spring (15 credit hours)
ARCH 5204 - Architectural History Topics (3)
ARCH 5304 - Structural Systems (3)
ARCH 5605 - Computational Practice (3)
ARCH 7102 - Design Studio Topics (6)

Year Three

Fall (15 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) *
ARCH 5305 - Building Systems Integration (3)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 7201 - Design Methodologies (3)
or ARCH 5204 - Architectural History Topics (3)

Spring (15 credit hours)
ARCH 5206 - Professional Practice (3)
ARCH 5050 - Architecture Topics (1 to 6) *
ARCH 5050 - Architecture Topics (3) *
ARCH 7104 - Design Studio: Diploma Project (6)

Optional Summer Session Courses

ARCH 5050 - Architecture Topics (1 to 6) *
ARCH 6890 - Directed Independent Study (1 to 6)

**ARCH 5204 or ARCH 6306 can be substituted for ARCH 5050. -*

Degree Total = 96 Credit Hours

Master of Architecture II Curriculum

The M.Arch. II curriculum requires a minimum of 60 credit hours to be completed during two academic years. If applicants accepted to the M.Arch. II curriculum are evaluated and found deficient in entry-level competencies, curriculum substitutions and/or additional courses will be required.

To ensure that incoming students are evaluated appropriately, the School of Architecture may require candidates for the M.Arch. II curriculum to furnish the

Architecture Graduate Admissions Committee and Graduate Program Coordinator relevant course descriptions, syllabi, and course materials (where necessary) of all architecture courses passed and completed that may satisfy entry-level competencies.

Year One

Fall (15 credit hours)
ARCH 5203 - Architectural History III: Survey of Contemporary Theory (1950-Present) (3)*
ARCH 5604 - Computational Methods (3)**
ARCH 6306 - Technology Topic (3)
ARCH 7101 - Design Studio: Topical (6)

** UNC Charlotte undergraduates who have previously taken ARCH 4203 should substitute ARCH 4205 - for ARCH 5203.*
*** UNC Charlotte undergraduates who have previously taken ARCH 4604 and/or ARCH 4065 should substitute architectural electives for ARCH 5604 and/or ARCH 5605.*

Spring (15 credit hours)
ARCH 5204 - Architectural History Topics (3)
ARCH 5605 - Computational Practice (3)
ARCH 6306 - Technology Topic (3)
ARCH 7102 - Design Studio Topics (6)

Year Two

Fall (15 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) ***
ARCH 5305 - Building Systems Integration (3)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 7201 - Design Methodologies (3)
or ARCH 5204 - Architectural History Topics (3)

Spring (15 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) *(6 credit hours required)* ***
ARCH 5206 - Professional Practice (3)
ARCH 7104 - Design Studio: Diploma Project (6)

****ARCH 5204, ARCH 6050, ARCH 6306, or ARCH 6890 can be substituted for ARCH 5050.*

Degree Total = 60 Credit Hours

Master of Architecture - Advanced Standing Curriculum

Highly qualified applicants from UNC Charlotte's Bachelor of Arts in Architecture program may be considered for Advanced Standing in the Master of Architecture program. The M.Arch. A.S. (Advanced Standing) is a 40 credit hour graduate degree path leading to an accredited professional degree in Architecture. The program builds upon a set of intensive summer experiences that bridge the undergraduate and graduate programs at UNC Charlotte.

Summer (10 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) (4 credit hours required)
ARCH 7101 - Design Studio: Topical (6)

Fall (15 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) (3 credit hours required) *
ARCH 5305 - Building Systems Integration (3)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 7201 - Design Methodologies (3)
or ARCH 5204 - Architectural History Topics (3)

Spring (15 credit hours)
ARCH 5050 - Architecture Topics (1 to 6) (3 credit hours required) *
ARCH 5305 - Building Systems Integration (3)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 7201 - Design Methodologies (3)
or ARCH 5204 - Architectural History Topics (3)

** ARCH 5204, ARCH 6306, or ARCH 6890 can be substituted for ARCH 5050.*

Degree Total = 40 Credit Hours

Grade Requirements

The School of Architecture's degree requirements follow those stated in the *Graduate Catalog*. Students must maintain a 3.0 GPA or greater to qualify for degree conferral.

Additionally, the M.Arch. requires that students: 1) may not receive more than one C in a design studio. If more than one C is assigned in required studios, then one studio (as determined by the Associate Director and Graduate Program Director) must be retaken with an earned grade of B or above.

Retaking a course may extend a student's time to degree status. No more than two (2) courses may be retaken in the program.

Integrated Path to Architectural Licensure (iPAL)

In 2015, the School of Architecture at UNC Charlotte was selected by the National Council of Architectural Registration Boards (NCARB) as one of 14 architecture programs in the U.S. to offer an inaugural "Integrated Path to Architectural Licensure" (iPAL) pathway as part of its NAAB-accredited M.Arch. programs. The iPAL curriculum integrates academic coursework, Architectural Experience Program (AXP) internship, and Architecture Registration Exam (ARE) as part of one's professional architectural education.

The core of the program features a structured full-time internship during summer terms, part-time internship during the academic year and a one-year, full-time internship prior to one's final year of study. The iPAL curriculum adds one year of office placement for those pursuing the M.Arch. II and M.Arch. A.S. tracks. Successful participants in the program are eligible for all six sections of the ARE prior to graduation. Candidates must have a record of at least 1250 hours of documented AXP credits prior to starting there M.Arch. curricula. Participants must submit their interests and qualifications via an application process after admittance to the M.Arch. Contact the Graduate Program Director for additional information about the iPAL pathway.

Architectural Elective Courses

Architectural Elective Courses are available in a wide variety of topical subjects, and are listed under the general course number ARCH 5050 or ARCH 6050, the technology topics number ARCH 6306, or the history/theory topics number ARCH 5204.

These courses complement the core courses and studios and allow students to pursue their specific interests. Architectural History Topics Courses complement the architectural history survey courses (ARCH 5201, ARCH 5202, ARCH 5203), and serve to inform and develop in-depth research, writing, and presentation skills. Entering MArch II students who have previously satisfied ARCH 5203 will be required to take an Architectural History Topic to satisfy their degree requirement.

Current elective offerings can be viewed in Banner Self Service or the School of Architecture website. Recent offerings have included:

History and Theory (ARCH 5204)

- Humanitarian Architecture
- From Auschwitz to Zapruder: Mapping the Mid-Century
- Histories of Latin American Architecture
- Architecture and Production
- Museums and Memorials
- Theories of Architectural Space

Architectural Technology (ARCH 6306)

- Sustainable Facade Systems
- Sustainability and Climate Responsive Architecture
- Atmospheric Animations
- Connective Environments
- Mobility on Demand Systems
- High Performance, Low Tech
- Build, Test, Iterate, Repeat

Computation (ARCH 5050/ARCH 6050)

- Scripting
- History of Computational Design
- Computational Theory
- Computational Research Methods

Urbanism (ARCH 5050/ARCH 6050)

- Engaging Urban Futures
- Community Planning Workshop
- Dilemmas of Modern City Planning
- Modern City: Theories and Forms
- Urban Form: Race and Place
- Hip Hop Urbanism

General Architecture Electives (ARCH 5050/ARCH 6050)

- Mark
- Structure of the Everyday
- Humanitarian Design
- Equity and Social Justice in Architecture
- Japanese Conceptions of Space
- Good Fast Cheap
- Public Transportation
- Airport Terminal Design
- The Material Landscape
- Detailing

Requisite and Capstone Experiences

Integrated Project Design

The Design Studio: Integrated Project Design (ARCH 7102) serves as the requisite studio experience that advances foundational studios and topical studios for all M.Arch. students. Taken in the sixth semester of enrollment for M.Arch. I students and in the third semester of enrollment for M.Arch. II students, the Design Studio: Integrated Project Design is defined as an architectural building design project that comprehensively demonstrates the student's ability to conceptualize, prepare, organize, and design a building having a specific programmatic type. All students must demonstrate competency before they engage in the final semester of study.

Diploma

The capstone for M.Arch. I, M.Arch. II, and M.Arch. AS students occurs in their final semester in ARCH 7104. This is defined as an architectural design diploma project that demonstrates the students' ability to apply research to identify and engage a specific set of issues, a building design construct, and a site or contextual condition.

Diploma project students, in conjunction with their studio professors, will identify the issue(s) to be engaged and the research and/or design methods through which this engagement will take place. Design research is defined as an architectural project that engages and explicates primary source material leading to project work possessing an original argument. This diploma project

includes design-related materials as part of the final submission. Materials from data and information gathered from original texts and documents, data resulting from experiments, demographic data, interviews, etc. are the means to base and launch the design activities of the diploma project.

For students in the M.Arch./M.U.D. dual degree program, the diploma project may have a focus on the integration of architectural and urban design issues.

Graduate Advising

A critical component of any successful graduate program is academic advising and guidance during the course of a student's program of study. The primary advisor for all graduate students in the School of Architecture is the Associate Director, in consultation with the appropriate Graduate Program Director.

Transfer Credit

Transfer credit may be possible up to a maximum of 20% of the overall course credit hours required for the Master of Architecture I and Master of Architecture II degree programs. Transfer credit is not accepted into the Master of Architecture II Advanced Standing (UNC Charlotte School of Architecture B.A. graduates only). The Associate Director and Graduate Program Director oversee all requests for such transfer credit.

Waiver Credit

Waiver credit may be allowed if a student can demonstrate that a course (or courses) taken at the post-undergraduate level equals or exceeds in both content and rigor of a course or courses required in the graduate curriculum. Grades received for such courses must be B or above. In such cases, credit is permitted by examination. If a required course in the curriculum is waived, the student is allowed to fill those credit hours with another course as advised by the Associate Director, in consultation with the Graduate Program Director.

Application for Degree

In order to meet UNC Charlotte's Graduate School requirements for degree candidacy, all graduate students must receive a written certification from their department confirming successful coursework completion. This report requires approvals from the Graduate Program Director as well as Graduate School administrators. The completion of this report results in the granting of the degree. In addition, each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Assistantships, Tuition Differentials, and Scholarships

A number of teaching and research assistantships, scholarships, tuition awards, and graduate tuition assistantship program support (GASP), are available to both high performing M.Arch. I, M.Arch. II, and M.Arch. A.S. candidates. No separate assistantship application is required; awards are based on application materials to the program, and award decisions are made based on the applicant's academic merit or promise of academic merit, and/or on demonstration of need. Portfolio and the merits of prior design work are extremely important in such award determinations. Tuition awards are typically paired with teaching and/or research assistantship stipends. School of Architecture scholarships supported through private endowments are available to students enrolled in the program pending an application. In addition, other awards are available under independent faculty or research center grants.

Master of Science in Architecture

The Master of Science (M.S.) in Architecture is a 30 credit hour degree focusing on emerging research critical to the architectural profession, which requires expertise that exceeds current criteria for accredited professional degrees. This non-professional degree curriculum is made up of core requirements (research methods and interdisciplinary skills) and research-based concentration areas.

Admission Requirements

M.S. in Architecture applicants must identify a potential research focus to be articulated as a part of their application in the Statement of Purpose. In addition to identifying a potential research focus, admission is based on an applicant's previous academic credentials, GRE scores, TOEFL scores (for international students), and a portfolio of material illustrative of the applicant's research interests such as reports, writing samples, computational models, etc.).

The minimum admission requirements for the M.S. in Architecture at UNC Charlotte are:

- An earned bachelor's degree from a college or university accredited by an accepted accrediting body
- An overall undergraduate GPA of at least a 3.0 (based on a 4.0 scale)
    - SoA UNC Charlotte B.Arch or M.Arch. degree holders with a 3.5 GPA or above are eligible to be considered for admission to the

M.S. in Architecture by submitting the Graduate School application and Statement of Purpose

- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (Internet-based) or a minimum IELTS band score of 6.5 required from any applicant whose native language is not English
- Satisfactory scores on the GRE or GMAT

The above admission requirements include the minimum admission standards for the UNC Charlotte Graduate School.

Documents To Be Submitted For Admission
Application to the M.S. in Architecture follows existing Graduate School and School of Architecture admissions processes. The UNC Charlotte application process is completely online.

To apply for graduate studies in the School of Architecture, all applicants must submit the following application materials to the UNC Charlotte Office of Graduate Admissions :

- Graduate School Application for Admission (online)
- Application Fee (payable online)
- Unofficial transcripts from all previous college-level institution(s) attended (submitted online)
- Official TOEFL scores
    - A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet-based) or a minimum IELTS band score of 6.5 required from any applicant whose native language is not English
- A statement of purpose (essay indicating research interest and potential faculty advisor) submitted online as part of the application submission process
- Three recommendations (submitted online by recommenders)
- Official GRE or GMAT scores
- A resume (submitted online)
- Digital Portfolio (20-page PDF document submitted online; this portfolio may include samples of writing, research, computation, and/or design-based projects)
    - SoA UNC Charlotte B.Arch or M.Arch. degree holders with a 3.5 GPA or above are eligible to be recommended for automatic admission to the School of Architecture and are not required to submit separate application materials such as a portfolio

Degree Requirements

Core Courses (21 credit hours)
ARCH 5611 - Research Methods I: Computational (3)
ARCH 6890 - Directed Independent Study (1 to 6)
ARCH 7210 - Thesis Prep (3)
ARCH 7211 - Studio Lab I (4 to 6)*
ARCH 7212 - Studio Lab II (4 to 6)*
ARCH 7213 - Thesis (6)

**The Studio Lab sections should be determined in consultation with the School of Architecture academic advisors.*

Concentration Courses (9 credit hours)
Select a concentration; courses should be determined in consultation with School of Architecture academic advisors.

Design Computation Concentration
ARCH 5201 - Architectural History I: Prehistory-1750 (3)
ARCH 5606 - Scripting (3)
ARCH 5607 - Digital Fabrication (3)
ARCH 5612 - Research Methods II (3)
ARCH 6050 - Architectural Elective (1 to 6) *(Composites Design topic)*
ARCH 6050 - Architectural Elective (1 to 6) *(GeoDesign topic)*
ARCH 6306 - Technology Topic (3) *(Qualitative Robotics topic)*
MUDD 6606 - GIS and Urban Mapping (3)

Design Science and Building Systems Concentration
ARCH 6050 - Architectural Elective (1 to 6) *(Sustainable Façade Design topic)*
ARCH 6306 - Technology Topic (3) *(Eco-Responsive Next Generation Facades topic)*
ARCH 6306 - Technology Topic (3) *(Daylighting I topic)*

Degree Total = 30 Credit Hours

Master of Urban Design

The Master of Urban Design (M.U.D) program prepares students and professionals to engage complex issues faced by towns and cities across America. The program uses the fast-changing Charlotte metropolitan region as its laboratory to provide students with relevant design skills to influence urban life under the pressures of globalization, environmental change, and cultural diversification. To emphasize this global perspective, part of the final Summer semester is based outside the U.S., framing Charlotte's design problems within a global context.

The first semester in the Fall focuses on the fundamental skills and techniques of urban design. The second semester in the Spring foregrounds issues of integrated networks, systems, and datascapes that affect urban life. The third semester during the Summer examines advanced topics through complex urban design problems in locations outside the U.S. Each semester also includes seminar courses, some of which comprise individual elective choices from a menu of topics in urban design

and urban history and theory.

The Master of Urban Design (M.U.D) degree serves two groups of students: (1) Students with an architecture or landscape architecture undergraduate or graduate degree (including a B.Arch. five-year degree) and (2) those holding a B.A. or B.S. undergraduate degree or a master's degree from disciplines other than architecture or landscape architecture. For those students with an architectural or landscape undergraduate or graduate qualifications, the courses within the program can be completed in one calendar year/three consecutive semesters of full-time enrollment from late August one year to early August the following year (Fall-Spring-Summer).

For students with undergraduate or graduate degrees in planning or other non-design disciplines, the program begins with an intensive second Summer semester experience in the July preceding enrollment in the Fall semester. Students with an interior design background will be evaluated on an individual basis regarding enrollment in this preparatory class.

The Master of Urban Design (M.U.D) degree can be taken as a stand-alone qualification, or may be combined with a Master of Architecture for a dual M.Arch./M.U.D degree. Opportunities also exist for students to craft individually approved curricula combining the M.U.D degree with the M.A. in Geography (Community Planning concentration) or with the Master of Science in Real Estate (M.S.R.E.). These dual degrees typically add two or more calendar years to a student's course of study.

Admission Requirements

Online applications must be made to the UNC Charlotte Graduate School. The following requirements are expected of applicants to the M.U.D. program:

- A minimum undergraduate GPA of 3.0
- UNC Charlotte Graduate School application requirements, including a statement of purpose describing objectives relative to graduate study in urban design, a current curriculum vitae (CV), transcripts from all other colleges and universities attended, GRE scores (where applicable), and three letters of recommendation
- School of Architecture application requirements, including a portfolio of creative work. Applicants should submit examples of work that offer evidence of creativity, self-motivation and critical appraisal. Such examples do not have to be solely urban design-related, but may also include visual work such as painting, sculpture, furniture making, photography, writing, and other reasonable evidence of their creative abilities. However, the portfolio must include some clear visual and/or written evidence of an interest in urban settings and conditions.

Automatic Recommendation for Admission

The School of Architecture Graduate Admissions Committee automatically endorses applications from UNC Charlotte four-year B.A. in Architecture degree holders with a GPA of 3.5 or above for courses in the major for acceptance to the M.U.D program. UNC Charlotte B.A. in Architecture students with a GPA of 3.5 do not need to submit the full application; however, must still apply to and be accepted by the UNC Charlotte Graduate School.

Dual Degree Admission

Students wishing to pursue a dual degree in a related field such as Architecture, Geography, or Real Estate should submit separate applications to those second degree programs, including the M.Arch., M.A. in Geography, or M.S.R.E. Applicants should be sure to meet all submission requirements of each program and are encouraged to reach out to the Graduate Program Directors of the second degree programs in which they are interested.

Degree Requirements

The M.U.D. program requires a minimum of 36 hours to be completed (39 hours for non-design based applicants). There are two study options: (1) a full-time program that can be completed in three consecutive semesters (Fall-Spring-Summer), or (2) a part-time option for working professionals that may be completed generally within two years. However, part-time students should note that the foreign-based Summer studio has to be taken as a full-time commitment.

Students enrolled in the dual degree M.Arch. II/M.U.D. program complete their extended program in three calendar years of full-time study, including the Summer semester spent abroad in either China, Europe, or South America, according to program rotation. The dual degree option is only available to full-time students.

A) Full-Time M.U.D. Option

Year One

Second Summer Session (3 credit hours)

MUDD 5101 - Design Studio: Basics (3) *(For non-design based applicants only. May be waived if determined in the admissions process.)*

Fall (12 credit hours)

MUDD 6101 - Fundamentals of Urban Design Studio (6)
MUDD 6205 - Modern City: Theories and Forms (3)
MUDD 6606 - GIS and Urban Mapping (3)

Spring (12 credit hours)

MUDD 5601 - Community Planning Workshop (3)
MUDD 6050 - Urban Design Elective (3)
MUDD 6102 - Urban Design Studio II (6)

Foreign-Based First Summer Session (6 credit hours)
MUDD 7120 - Graduate Summer International Study (3 to 6)

Charlotte-Based Second Summer Session (6 credit hours)
MUDD 7102 - Urban Design Studio III (3 or 6)

B) Part-Time M.U.D. Option

Year One

Summer (3 credit hours)
MUDD 5101 - Design Studio: Basics (3) *(For non-design based applicants only. - May be waived if determined in the admissions process.)*

Fall (6 credit hours)
MUDD 6205 - Modern City: Theories and Forms (3)
MUDD 6606 - GIS and Urban Mapping (3)

Spring (6 credit hours)
MUDD 5601 - Community Planning Workshop (3)
MUDD 6050 - Urban Design Elective (3)

Year Two

Fall (6 credit hours)
MUDD 6101 - Fundamentals of Urban Design Studio (6)

Spring (6 credit hours)
MUDD 6102 - Urban Design Studio II (6)

Foreign-Based First Summer Session (6 credit hours)
MUDD 7120 - Graduate Summer International Study (3 to 6)

Charlotte-Based Second Summer Session (6 credit hours)
MUDD 7102 - Urban Design Studio III (3 or 6)

Urban Design Elective Courses

Urban Design Elective Courses are available in a wide variety of topical subjects, and are listed under the general course number MUDD 6050. These courses complement the core courses and studios and allow students to pursue their specific interests. These may be repeated for credit with change of topic. Topics include: Computation, Theory, Representation, Making, Urbanism, and Technology. Current elective offerings can be viewed in the Schedule of Classes or the School of Architecture website.

Degree Total = 36-39 Credit Hours

Master of Architecture and Urban Design Dual Degree

The curriculum for the dual M.Arch./M.U.D. degree is noted below. Students admitted to this program typically are enrolled in M.Arch. courses for their first year, and study in M.U.D. program in their second year and participate in the M.U.D. summer program, and be enrolled in M.Arch. courses for their final year to complete their dual-degree program.

Customized curricula for the dual degree opportunities of M.U.D./M.A. in Geography (Community Planning) and M.U.D./M.S.R.E. (Real Estate) are developed to suit the individual student interested in these options once the student is accepted onto both programs.

Master of Architecture/Master of Urban Design Curriculum

The dual M.Arch/M.U.D. degree requires a minimum of 84 credit hours to be completed. Typically, the 12-month M.U.D. portion of the dual degree is taken in the second year of the three-year sequence (as shown below). However, by special agreement of the student and the M.Arch. and M.U.D. Program Directors, the 12-month M.U.D. portion may be completed in the first or final year of the three-year sequence.

Year One

Fall (15 credit hours)
ARCH 7101 - Design Studio: Topical (6)
ARCH 5203 - Architectural History III: Survey of Contemporary Theory (1950-Present) (3)*
ARCH 5604 - Computational Methods (3)**
ARCH 6306 - Technology Topic (3)

**UNC Charlotte undergraduates who have previously taken ARCH 4203 should substitute ARCH 5204 for ARCH 5203.*
*** UNC Charlotte undergraduates who have previously taken ARCH 4604 should substitute ARCH 6050 for ARCH 5604.*

Spring (9 credit hours)
ARCH 5204 - Architectural History Topics (3)
ARCH 5605 - Computational Practice (3)
ARCH 6306 - Technology Topic (3)

Year Two

Fall (12 credit hours)
MUDD 5601 - Community Planning Workshop (3)
MUDD 6101 - Fundamentals of Urban Design Studio (6)
MUDD 6205 - Modern City: Theories and Forms (3)

Spring (9 credit hours)
MUDD 6102 - Urban Design Studio II (6)
MUDD 6204 - Geographic Information System (3)

Foreign-Based First Summer Session (6 credit hours)
MUDD 6050 - Urban Design Elective
MUDD 7102 - Vertical Urbanism / Global Urban Design Studio, Part I (3)

Charlotte-Based Second Summer Session (6 credit hours)
MUDD 5602 - Planning, Law, and Urban Design (3)
MUDD 7103 - Vertical Urbanism / Global Urban Design Studio, Part II (3)

Year Three

Fall (15 credit hours)
ARCH 5305 - Building Systems Integration (3)
ARCH 6050 - Architecture Elective (3)***
ARCH 7102 - Design Studio Topics (6)
ARCH 7201 - Design Methodologies (3)

Spring (12 credit hours)
ARCH 7104 - Design Studio: Diploma Project (6)
ARCH 5206 - Professional Practice (3)
ARCH 6050 - Architecture Elective (3)***

****ARCH 5204 (Architecture History Elective) or ARCH 6306 (Technology Topic) may be substituted for ARCH 6050. -*

Optional Summer Session Courses
ARCH 5204 - Architectural History Topics (3) *(Study Abroad)*
ARCH 6050 - Architectural Elective (1 to 6)
ARCH 6890 - Directed Independent Study (1 to 6)

Capstone Studios and Final Diploma Project

Students enrolled in the Dual Degree M.Arch./M.U.D. program are required to complete two M.U.D. Capstone Studios: (MUDD 7102 and MUDD 7103), and an Architectural Diploma Studio (ARCH 7104). The architectural diploma studio project may incorporate a focus on the integration of architectural and urban design issues.

Graduate Advising

A critical component of any successful graduate program is academic advising and guidance during the course of a student's program of study. The primary advisors for all urban design graduate students in the School of Architecture will be the Associate Director of the School of Architecture, in consultation with the Director of the Urban Design Program.

Transfer Credit

Transfer credit may be granted under special circumstances (e.g., approved post-baccalaureate status prior to entry into the program).

Waiver Credit

Waiver credit may be allowed if a student can demonstrate that a course or courses taken in his or her prior undergraduate or graduate curriculum equals or exceeds in both content and rigor of a course or courses required in the graduate curriculum. If a required course in the curriculum is waived, the student will be allowed to fill those credit hours with another course as advised by the Associate Director of the School of Architecture, in consultation with the Director of the Urban Design Program.

Application for Degree

In order to meet UNC Charlotte's Graduate School requirements for degree candidacy, all graduate students must complete and pass coursework involving capstone projects. For urban design students, this comprises completion of the two summer design studios. For dual degree students, this includes the urban design capstone as well as completion of an architectural diploma project in the final year. Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Research and Study Abroad Opportunities

M.U.D. and Dual Degree students may engage in research activities via the School of Architecture's City Building Lab (CBL). All students automatically obtain international study experience through the required global Summer studio.

Assistantships, Tuition Differentials, and Scholarships

A number of research assistantships, scholarships, and tuition waivers are available to M.U.D. candidates. No separate assistantship application is necessary; awards are based on application materials to the program, and award decisions are based on the applicant's academic merit or promise of academic merit, and/or on demonstration of need.

Master of Architecture and M.S. in Information Technology Dual Degree

Design has become increasingly important to computer scientists and at the same time computation has become important to designers. The dual degree program in

Architecture and Information Technology program is a unique curriculum that systematically combines the strength and insights of these disciplines. Students in this dual degree program enroll simultaneously in both degree programs.

As computing has matured as a discipline, it has expanded its focus to include the physical and virtual settings in which users interact with the machine. Specialties like human computer interaction, ubiquitous computing, gaming, and visualization require an understanding not only of the logic of the machine, but also the logic of the user. Based on these concerns, the design thinking ability that is an integral part of design training is of interest as an alternative paradigm that may change the way that students think and operate.

Within architecture, there is a unique opportunity to develop students who will have the knowledge to lead the integration of the computer into architectural practice and research. As firms rely more and more on computation, those who know how to think, program, and script will be able to change the way architects design and practice. We see the day fast approaching when the IT department at firms is not separate but rather is at the core of what architects do. Already, in advanced practices across the world, computing and design are intermingling.

The curriculum integrates architecture students with information technology students, working collaboratively on tasks that challenge both fields. Early in the curriculum, the cohorts with architecture background and those with computing background take courses to provide basic competency in a new discipline.

A two-semester sequence of studio lab courses focuses on issues and problems that are researched by design teams.

Note: The Master of Architecture in the School of Architecture is fully accredited through the National Architectural Accrediting Board (NAAB). The architecture curriculum included in this dual degree program meets all NAAB professional degree requirements needed for licensure as a registered architect.

Admission Requirements

Interested students should apply to the Master of Architecture and be evaluated by the graduate admissions committee of the School of Architecture, as well as apply for the Master of Information Technology and be evaluated by the graduate admissions committee of the Department of Software and Information Systems. Admitted students are expected to complete all coursework outlined below to receive both degrees. Upon successful completion of all requirements, students receive both the Master of Architecture degree and the M.S. in Information Technology degree.

Eligibility

The minimum admission requirements for the Master of Architecture are:

- An earned bachelor's degree from a college or university accredited by an accepted accrediting body
- An overall undergraduate GPA of at least a 3.0 (based on a 4.0 scale)
- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet-based) or a minimum IELTS band score of 6.5 required from any applicant whose native language is not English

Documents To Be Submitted For Admission

To apply for graduate studies in the School of Architecture, all applicants must submit the following application materials to the UNC Charlotte Office of Graduate Admissions:

- Graduate School Application for Admission (online)
- Application Fee (payable online)
- Unofficial transcripts from all previous college-level institution(s) attended (submitted online)
- Official TOEFL scores
- Official GRE or GMAT scores (sent directly online from testing services)
- Three recommendations (submitted online by recommenders)
- A resume (submitted online)
- A statement of purpose indicating research interest and potential faculty advisor (submitted online)
- Digital Portfolio illustrative of research interests and design background

Automatic Recommendation for Admissions for Master of Architecture

The School of Architecture Graduate Admissions Committee will automatically endorse applications from UNC Charlotte four-year Bachelor of Arts in Architecture degree holders with a GPA of 3.5 or above for courses in the major for acceptance to the Master of Architecture program. UNC Charlotte B.A. in Architecture students with a GPA of 3.5 do not need to submit the full School of Architecture application; however, must still apply to and be accepted by the MSIT admissions committee and the UNC Charlotte Graduate School.

M.Arch. II / MSIT Degree Requirements

The M.Arch. Advanced Standing / MSIT Dual Degree takes three years and a total of 83 credit hours to complete.

Year One

Fall (15 credit hours)
ARCH 7101 - Design Studio: Topical (6)
ARCH 5203 - Architectural History III: Survey of Contemporary Theory (1950-Present) (3)
ARCH 5604 - Computational Methods (3)
ARCH 6306 - Technology Topic (3) *(Connective Environments)*

Spring (15 credit hours)
ARCH 7102 - Design Studio Topics (6)
ARCH 5204 - Architectural History Topics (3)
ARCH 5605 - Computational Practice (3)
ITIS 6400 - Human-Centered Design (3)

Year Two

Fall (15 credit hours)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 5305 - Building Systems Integration (3)
ARCH 5611 - Research Methods I: Computational (3)
ITCS 5122 - Visual Analytics (3)

Spring (13 credit hours)
ARCH 7211 - Studio Lab I (4 to 6) *(4 credit hours required)*
ARCH 5612 - Research Methods II (3)
ITIS 5166 - Network-Based Application Development (3)
ITIS 6120 - Applied Databases (3)

Year Three

Fall (13 credit hours)
ARCH 7212 - Studio Lab II (4 to 6) *(4 credit hours required)*
ARCH 7210 - Thesis Prep (3)
ITCS 6010 - Topics in Computer Science (3)*
ITCS 6112 - Software System Design and Implementation (3)

** Other ITCS courses may be substituted for ITCS 6010.*

Spring (12 credit hours)
ARCH 7213 - Thesis (6) *(ITIS-IT Project (Capstone Report))*
ARCH 5206 - Professional Practice (3)
ITIS 6342 - Information Technology Project Management (3)

M.Arch. II / MSIT Degree Requirements

The M.Arch. Advanced Standing / MSIT Dual Degree takes three years and a total of 83 credit hours to complete.

Year One

Summer (12 credit hours)
ARCH 7101 - Design Studio: Topical (6)
ITCS 5122 - Visual Analytics (3)
DSBA 6100 - Big Data Analytics for Competitive Advantage (3)

Fall (15 credit hours)
ARCH 7103 - Design Studio Integrated Project (6)
ARCH 5305 - Building Systems Integration (3)
ARCH 5611 - Research Methods I: Computational (3)
ARCH 6306 - Technology Topic (3) *(Connective Environments)*

Spring (13 credit hours)
ARCH 7211 - Studio Lab I (4 to 6) *(4 credit hours required)*
ARCH 5612 - Research Methods II (3)
ITIS 6120 - Applied Databases (3)
ITIS 6400 - Human-Centered Design (3)

Year Two

Fall (13 credit hours)
ARCH 7210 - Thesis Prep (3)
ARCH 7212 - Studio Lab II (4 to 6) *(4 credit hours required)*
ITIS 5166 - Network-Based Application Development (3)
ITIS 6112 - Software System Design and Implementation (3)

Spring (12 credit hours)
ARCH 7213 - Thesis (6) *(ITIS-IT Project (Capstone Report))*
ARCH 5206 - Professional Practice (3)
ITIS 6342 - Information Technology Project Management (3)

Dual Degree Total = 83 Credit Hours

M.S. in Architecture and M.S. in Information Technology Dual Degree

Design has become increasingly important to computer scientists, and at the same time computation has become important to designers. The Master of Science in Architecture and Master of Science in Information Technology dual degree program is a unique curriculum that systematically combines the strength and insights of these disciplines. Students enroll simultaneously in these two M.S. degree programs.

As computing has matured as a discipline, it has expanded its focus to include the physical and virtual settings in which users interact with the machine. Specialties like human computer interaction, ubiquitous computing, gaming, and visualization require an understanding not only of the logic of the machine, but also the logic of the user. Based on these concerns, the design thinking ability that is an integral part of design training is of interest as an alternative paradigm that may change the way that students think and operate.

Within architecture and its allied fields, there is a unique opportunity to develop students who will have the

knowledge to lead the integration of the computer into architectural research. As firms rely more and more on computation, those who know how to think, program, and script will be able to change the way architects design and practice. We see the day fast approaching when the IT department at firms is not separate but rather is at the core of what architects do. Already, in advanced practices across the world, computing and design are intermingling.

The curriculum integrates M.S. in Architecture students with M.S. in Information Technology students, working collaboratively on tasks that challenge both fields. A two-semester sequence of studio lab courses focuses on issues and problems that are researched by design teams.

Note: The Master of Science in Architecture, because of its research focus, is not a NAAB accredited program that can lead to licensure as a registered architect. The School of Architecture does offer a NAAB accredited Master of Architecture, which is a separate degree program.

Admission Requirements

Interested students should apply to the Master of Science in Architecture and be evaluated by the graduate admissions committee of the School of Architecture, as well as apply for the Master of Science in Information Technology, and be evaluated by the graduate admissions committee of the Department of Software and Information Systems. Upon successful completion of all requirements and coursework outlined below, students receive both master's degrees.

Eligibility

The minimum admission requirements for the M.S. in Architecture are:

- An earned bachelor's degree from a college or university accredited by an accepted accrediting body
- An overall undergraduate GPA of at least a 3.0 (based on a 4.0 scale)
- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (Internet-based) or a minimum IELTS band score of 6.5 required from any applicant whose native language is not English

In addition to the established Graduate School admissions criteria, admission to the dual degree program requires one of the following:

- A degree in architecture or a related design discipline
- An undergraduate degree in computer science, information technology, or a related discipline

Students without an undergraduate degree in a computing-related discipline must have one of the following:

- A summer programming course (boot camp) offered by the College of Computing and Informatics
- An introductory programming course as part of a bachelor's degree
- A certificate in a programming course offered online that is approved by the admission committee for the dual degree program

Documents To Be Submitted For Admission

To apply for graduate studies in the School of Architecture, all applicants must submit the following application materials to the UNC Charlotte Office of Graduate Admissions:

- Graduate School Application for Admission (online)
- Application Fee (payable online)
- Unofficial transcripts from all previous college-level institution(s) attended (submitted online)
- Official TOEFL scores
- Official GRE or GMAT scores (sent directly online from testing services)
- Three recommendations (submitted online by recommenders)
- A resume (submitted online)
- A statement of purpose indicating research interest and potential faculty advisor (submitted online)
- Digital Portfolio illustrative of research interests (20-page PDF document that may include samples of writing, research, reports, and/or design-based projects)

Automatic Recommendation for Admissions for M.S. in Architecture

The School of Architecture Graduate Admissions Committee will automatically endorse applications from UNC Charlotte four-year Bachelor of Arts in Architecture degree holders with a GPA of 3.5 or above for courses in the major for acceptance to the M.S. in Architecture program. UNC Charlotte B.A. in Architecture students with a GPA of 3.5 do not need to submit the full School of Architecture application; however, must still apply to and be accepted by the M.S. in Information Technology Admissions Committee and the UNC Charlotte Graduate School.

Degree Requirements

Year One

Fall (12 credit hours)

ARCH 5611 - Research Methods I: Computational (3)
ARCH 6306 - Technology Topic (3) *(Connective Environments)*
ITIS 6120 - Applied Databases (3)
ITIS 6400 - Human-Centered Design (3)

Spring (13 credit hours)

ARCH 5050 - Architecture Topics (1 to 6) *(3 credit hours required)**

ARCH 5612 - Research Methods II (3)
ARCH 7211 - Studio Lab I (4 to 6) *(4 credit hours required)*
ITIS 6010 - Topics in Software and Information Systems (3)**

** ARCH 6050, ARCH 6306, or ARCH 6890 may be substituted for ARCH 5050*
*** Other ITIS courses may be substituted for ITIS 6010*

Year Two

Fall (16 credit hours)
ARCH 7210 - Thesis Prep (3)
ARCH 7212 - Studio Lab II (4 to 6) *(4 credit hours required)*
ITCS 6112 - Software System Design and Implementation (3)
ITIS 5166 - Network-Based Application Development (3)
ITIS 6500 - Complex Adaptive Systems (3)

Spring (9 credit hours)
ARCH 7213 - Thesis (6) *(ITIS - IT Project (Capstone Report))*
ITIS 6342 - Information Technology Project Management (3)

Dual Degree Total = 50 Credit Hours

Grade Requirements
Students in the M.S. in Architecture and M.S. in Information Technology dual degree program are expected to earn a grade of A or B in all courses included in the curriculum and must maintain a minimum cumulative 3.0 GPA (on a 4.0 scale). As per UNC Charlotte Graduate School Master's Degree Requirements, students must maintain "an overall GPA of 3.0 or above in courses on the degree plan of study. No more than six hours evaluated as C may be counted toward the minimum hours required for the master's degree." An accumulation of three C letter grades will result in the suspension of a student's enrollment in the program.

MUSIC

- Graduate Certificate in Vocal Pedagogy

Department of Music
music.charlotte.edu

Graduate Certificate in Vocal Pedagogy

The Graduate Certificate in Vocal Pedagogy is designed to provide the advanced student with a concentrated program focusing on the methodology and practice of teaching voice. The curriculum consists of 17 hours of graduate level work that can be completed in two semesters over one academic year. The course of study includes private lessons, masterclasses, internships teaching in one-on-one and/or group situations, and a graduate pedagogy sequence culminating in a directed project.

Admission Requirements
1) A bachelor's degree in music from a university or conservatory accredited by an accepted accrediting body
2) Online application to Graduate Admissions, accompanied by the application fee in effect
3) GPA required for entry into a master's degree program
4) Official transcripts
5) Formal audition for acceptance as a post-baccalaureate student
6) Placement tests in music theory, ear training, and piano; any deficiencies revealed in the placement tests may be remedied through coursework at UNC Charlotte or any institution accredited by an accepted accrediting body
7) A diagnostic vocal pedagogy exam will be administered prior to placement into the program

Certificate Requirements
Students must take all of the courses below to complete the Graduate Certificate in Vocal Pedagogy. All courses must be taken at UNC Charlotte and must be completed within five years.

MUSC 5137 - Graduate Vocal Pedagogy I (3)
MUSC 5153 - Graduate Vocal Pedagogy II (3)
MUSC 6453 - Voice Teaching Internship (2) *(two semesters)*
MUPF 6253 - Applied Music Voice (2) *(two semesters)*
MUPF 6253L - Voice Masterclass (0) *(two semesters)*
MUSC 6600 - Concluding Seminar (3)

Certificate Total = 17 Credit Hours

Belk College of Business

belkcollege.charlotte.edu

The Belk College of Business is accredited by AACSB International, the premier accrediting agency for academic programs in business administration and accounting. The Belk College offers challenging master's programs in Accountancy, Business Administration, Economics, Management, Mathematical Finance, and Real Estate that provide graduates with the tools they need to succeed in business. Courses are taught by faculty whose research is published in top-level journals and whose expertise is highly sought after by industry executives. Students have the opportunity to network with professionals from a variety of fields, and interact with alumni and leaders from Charlotte's dynamic business community. These programs provide flexible schedules with courses offered both at UNC Charlotte's main campus and at the Dubois Center in the heart of Charlotte's Uptown Business District, so that working professionals may earn a graduate degree without interrupting their careers.

College of Business Graduate Degree Programs

- Doctor of Business Administration
- Ph.D. in Business Administration
- Master of Accountancy
- Master of Business Administration
- Master of Science in Economics
- Master of Science in Management
- Master of Science in Real Estate

Interdisciplinary Degree Programs

- M.S. in Data Science and Business Analytics *(see the "School of Data Science" section of this Catalog)*
- Dual MBA with specialization in Global Business and Strategy *(in conjunction with the Graduate School of Business Administration and Leadership (EGADE) at Tecnológico de Monterrey)*
- MBA/MHA Dual Degree *(in collaboration with the College of Health and Human Services)*
- M.S./M.Sc. in Economics *(in conjunction with Copenhagen Business School (CBS))*
- M.S. in Mathematical Finance *(The Departments of Finance and Economics in the Belk College of Business collaborate with the Department of Mathematics and Statistics in the College of Liberal Arts & Studies in this interdisciplinary program)*
- M.S. in Mathematical Finance/MBA Dual Degree
- M.S. in Mathematical Finance/M.S. in Economics Dual Degree
- M.S. in Mathematical Finance/Laurea Magistrale (LM) in Banking and Finance Dual Degree *(in conjunction with Università Cattolica del Sacro Cuore (UCSC))*
- M.S. in Mathematical Finance/Master's in International Business Dual Degree *(in conjunction with Shanghai University of Finance and Economics (SUFE))*

- M.S. in Real Estate/MBA Dual Degree
- Ph.D. in Computing and Information Systems - Business Track
  (The Belk College collaborates with the College of Computing & Informatics on the Business Track in this multidisciplinary program, located in the "College of Computing and Informatics" section of this Catalog)
- Ph.D. in Organizational Science
  (Faculty from the Belk College's Department of Management teach in this multidisciplinary program, located in the "College of Liberal Arts & Sciences" section of this Catalog)
- Ph.D. in Public Policy
  (Faculty from the Belk College's Department of Economics teach in this multidisciplinary program, located in the "College of Liberal Arts & Sciences" section of this Catalog)

Graduate Non-Degree Programs

- MBA PLUS Post-Master's Certificate
- Graduate Certificate in Applied Econometrics
- Graduate Certificate in Business Analytics
- Graduate Certificate in Data Science and Business Analytics *(see the "College of Computing and Informatics" section of this Catalog)*
- Graduate Certificate in Entrepreneurship and Innovation
- Graduate Certificate in Global Business and Strategy *(in conjunction with the MBA in Global Business and Strategy Dual Degree)*
- Graduate Certificate in Real Estate and Development

ACCOUNTANCY

- Master of Accountancy (MACC)
  - Financial Accounting/Auditing
  - Professional Accounting
  - Tax
  - Individualized

Turner School of Accountancy

macc.charlotte.edu

Master of Accountancy

The Master of Accountancy (MACC) program is a multiple concentration program designed to prepare accountants for the rapidly changing expectations of the accounting profession. The program has three concentrations: (1) Professional Accounting, (2) Financial Accounting/Auditing, and (3) Tax. The program also includes the option for development of an individualized program of study. Completion of the Professional Accounting concentration or the Financial Accounting/Auditing concentration enables students to pursue licensure in states requiring 150 credit hours.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, an acceptable score on the verbal and quantitative portions of the Graduate Management Admission Test (GMAT) is required for graduate study in Accounting. A Graduate Record Exam (GRE) score may be submitted in lieu of a GMAT score.

The GMAT/GRE application requirement may be waived for applicants meeting the following criteria:

- UNC Charlotte undergraduate accounting students - 3.0 or higher undergraduate GPA (UGPA), 3.0 or higher UGPA from 3000 and 4000 accounting level courses, and must also provide letters of recommendation from three 3000 and/or 4000 accounting professors
- General applicants – at least a 3.0 UGPA, and can showcase quantitative and analytical strengths from their undergraduate coursework

Waiver must be requested from the Master of Accountancy Graduate Program Director when submitting the completed application. All GMAT/GRE waivers are at the discretion of the Master of Accountancy Graduate Program Director. If candidates are unable to secure the GMAT/GRE waiver, they will be required to submit official GMAT/GRE test scores in their Master of Accountancy application.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The program leading to the Master of Accountancy degree consists of 30 credit hours (10 graduate courses) of coursework for students with an accounting undergraduate degree and 36 hours for students who do not have an accounting undergraduate degree. The coursework is divided into two components: accounting classes and elective classes. See the concentration descriptions below for more information on required and elective courses. Neither a comprehensive examination nor a thesis is required; however, each concentration has a designated capstone course.

Concentrations

Professional Accounting Concentration

The Concentration in Professional Accounting is designed for students who have an interest in preparing for careers in public accounting, consulting, and corporate accounting. The concentration is designed for students who do not have an undergraduate degree in accounting. It is also designed for students who have an undergraduate degree in accounting from outside of the United States. The program is offered in both full-time and part-time formats, with classes offered both during the daytime and in the evenings. Students planning to pursue full-time study should plan to begin the program during the summer.

Required Courses (21 credit hours)

ACCT 5220 - Income Tax (3)
ACCT 5311 - Intermediate Financial Reporting I (3)*
ACCT 5312 - Intermediate Financial Reporting II (3)*
ACCT 6120 - Taxation of Corporations and Shareholders (3)
ACCT 6220 - Financial Statement Auditing (3)
ACCT 6260 - Advanced Financial Reporting (3)
ACCT 6270 - Accounting for Business Combinations, Governmental, and Not-for-Profit Entities (3)

**ACCT 5311 and ACCT 5312 or equivalent must be completed with a grade of B or above or permission of the MACC program director before taking the other courses in the program.*

Capstone Course (3 credit hours)

ACCT 6280 - International Financial Reporting (3)

Elective Courses (12 credit hours)

In addition to the required and capstone courses, students are expected to complete four elective courses. Elective courses may be chosen from other courses offered by the MACC program, courses from other master's programs offered by the Belk College of Business, and courses from other master's programs offered by the University. Courses chosen from other College of Business master's programs must be approved by the Program Director of that program. Courses chosen outside of the College of Business can be taken only with permission of both the MACC Program Director and the Program Director for the specific program offering the course.

Financial Accounting/Auditing Concentration

The Concentration in Financial Accounting/Auditing is designed for students wishing to pursue careers in public accounting, consulting, and corporate accounting. The concentration is designed for students who have an undergraduate degree or equivalent in accounting from a U.S. university. The program is offered in both full-time and part-time formats with classes offered both during the daytime and in the evenings.

Required Courses (12 credit hours)

ACCT 6120 - Taxation of Corporations and Shareholders (3)
ACCT 6220 - Financial Statement Auditing (3)
ACCT 6260 - Advanced Financial Reporting (3)
ACCT 6270 - Accounting for Business Combinations, Governmental, and Not-for-Profit Entities (3)

Capstone Course (3 credit hours)

ACCT 6280 International Financial Reporting (3)

Elective Courses (15 credit hours)

In addition to the required and capstone courses, students are expected to complete five elective courses. Elective courses may be chosen from other courses offered by the MACC program, courses from other master's programs offered by the Belk College of Business, and courses from other master's programs offered by the University. Courses chosen from other College of Business master's programs must be approved by the Program Director of that program. Courses chosen outside of the College of Business can be taken only with permission of both the MACC Program Director and the Program Director for the specific program offering the course.

Tax Concentration

The Concentration in Tax is designed for students who wish to specialize in taxation. Students can enroll in the Tax concentration with or without an undergraduate degree in Accounting. The program is offered in both full-time and part-time formats with tax classes offered in only the evenings.

Prerequisite Courses (6 credit hours)
ACCT 2121 - Introduction to Financial Accounting (3)
ACCT 4220 - Income Tax - (3)
or ACCT 5220 - Income Tax (3)
(or equivalents)

Required Tax Courses (12 credit hours)
ACCT 6110 - Tax Research and Planning (3)
ACCT 6120 - Taxation of Corporations and Shareholders (3)

Elective Tax Courses (12 credit hours)
Select two of the following:
ACCT 6130 - Taxation of Pass-Through Entities (3)
ACCT 6140 - Taxation of Estates, Gifts, and Trusts (3)
ACCT 6160 - Advanced Individual Taxation (3)

Capstone Course (3 credit hours)
ACCT 6150 - Tax Strategy and Policy (3)

Elective Courses (15 credit hours)
Five additional courses beyond the required tax courses, elective tax courses, and capstone course are required. MACC and MBA courses may be taken to fulfill these electives. Students may also take courses from other graduate programs offered by the University with permission from the Graduate Program Director. Elective courses are available for students who wish to specialize in tax and also prepare for the CPA exam.

Individualized Accounting Concentration

The Individualized Accounting concentration is designed for students with unique career and professional goals that are not met by any of the other concentrations. The Individualized Accounting concentration consists of 10 courses, at least five of which must be from the MACC curricula, with the remaining five courses chosen as elective courses. Consultation with the Program Director is required for this concentration.

Elective courses may be chosen from other courses offered by the MACC program, courses from other master's programs offered by the Belk College of Business, and courses from other master's programs offered by the University. Courses chosen from other College of Business master's programs must be approved by the Program Director of that program. Courses chosen outside of the College of Business can be taken only with permission of both the MACC Program Director and the Program Director for the specific program offering the course.

Degree Total = 30 Credit Hours

Grade Requirements

Due to the importance of having a strong foundation in financial reporting, all MACC students are required to have earned a grade of B or above in Intermediate Accounting I and II.

Advising

Prior to, or concurrent with, the start of the first semester of study, students are expected to complete a program of study listing each course they expect to take as a part of the program.

Application for Degree

Students should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Assistantships

Assistantships are available on a competitive basis.

Program Certifications/Accreditation

The Belk College of Business and the Turner School of Accountancy are accredited by The Association to Advance Collegiate Schools of Business (AACSB International).

BUSINESS ADMINISTRATION

- Doctor of Business Administration (DBA)
- Ph.D. in Business Administration
- Master of Business Administration (MBA)
  - Applied Investment Management
  - Business Analytics
  - Business Finance
  - Energy
  - Entrepreneurship and Corporate Venturing
  - Financial Institutions/Commercial Banking
  - Global Business
  - Information and Technology Management
  - Innovation and Growth Strategies
  - Management
  - Marketing
  - Marketing Analytics
  - Quantitative Methods for Business
  - Real Estate Finance and Development
  - Supply Chain Management
  - Student Structured
- MBA/MHA Dual Degree *(in collaboration with the College of Health and Human Services)*
- MBA/M.S. in Mathematical Finance Dual Degree *(see the Mathematical Finance section)*
- MBA/M.S. in Real Estate Dual Degree *(see the Real Estate section)*
- Dual MBA Degree *(in conjunction with the Graduate School of Business and Leadership (EGADE)) (See the Global Business section)*
- MBA PLUS Post-Master's Certificate
- Graduate Certificate in Business Analytics
- Graduate Certificate in Entrepreneurship and Innovation

Doctor of Business Administration (DBA)

Graduate Program

dba.charlotte.edu

The Doctor of Business Administration (DBA) is a professional degree taught in an executive format designed to prepare graduates for leadership positions in organizations and teaching careers in academia. The program focuses on research methodology with practice-focus content and projects that address issues confronting contemporary business leaders. Students gain an advanced level of knowledge in the following major fields: management, marketing, operations management and information systems. In addition, students are expected to demonstrate mastery of the existing body of knowledge in their major field and to develop new knowledge through original independent research. With the educational background provided by the program, graduates are qualified to lead organizations as senior executives and change agents, acquire faculty positions in academic institutions, and launch successful careers in management consulting.

Admission Requirements

All applicants seeking admission to the DBA program must fulfill the University's general requirements for graduate admission at the Ph.D. level. Additional requirements for admission into the program include:

- An earned MBA or master's degree in a related field from a college or university accredited by an accepted accrediting body with a minimum GPA of at least 3.0 on a 4.0 scale
- Five or more years of professional working experience
- For non-native speakers of English, a score of 557 on the paper-based TOEFL, a score of 83on the internet-based TOEFL, or a band score of 6.5 on the IELTS
- Three positive letters of recommendation
- Two essays: one addressing the candidate's goals and motivations for pursuing the DBA and the second outlining the candidate's general areas of research interest
- Other credentials as required by the Graduate school or the executive DBA program committee

Students are admitted to the program by the Dean of the Graduate School based on the recommendation of the Belk College of Business DBA Program Director, in consultation with the Belk College of Business DBA Program Committee. Recommendations are based on the assessments of the Program Director and Program

Committee of the candidate's ability to complete the program, as supported by the application materials. If there are more candidates than can be accommodated, candidates are recommended in order of their perceived ability, promise of success, and suitability to the program.

Degree Requirements

The degree of Doctor of Business Administration is awarded for completion of scholarly research that advances knowledge in the fields of business theory or practice. Evidence of this is demonstrated by a successful dissertation defense. Additionally, recipients of this degree must demonstrate mastery of the body of knowledge within the field and potential for success in future leadership positions and academia.

The DBA is a three-year (six-semester), lockstep program consisting of 18 three-credit hour courses. The program requires 54 post-master's credit hours. The curriculum has three major components:

Research Methodology Courses (21 credit hours)
BDBA 8100 - Introduction to Experimental Design and Measurement (3)
BDBA 8130 - Introduction to Business Theory (3)
BDBA 8140 - Advanced Business Theory (3)
BDBA 8150 - Business Statistics and Data Analysis (3)
BDBA 8200 - Research Methods I (3)
BDBA 8230 - Research Methods II (3)
BDBA 8350 - Dissertation Proposal Development (3)

Seminars in Applied Research (15 credit hours)
BDBA 8110 - Organizational Theory and Systems (3)
BDBA 8120 - Professional Issues I (3)
BDBA 8210 - Current Topics Research Seminar (3)
BDBA 8220 - Professional Issues II (3)
BDBA 8240 - Focused Research Seminar (3)

Note: BDBA 8100, BDBA 8110, and BDBA 8120 fulfill the Responsible Conduct of Research (RCR) requirement for DBA students.

Dissertation (18 credit hours)
BDBA 8999 - Doctoral Dissertation Research (1 to 9)

Degree Total = 54 Credit Hours

Grade Requirements

Students are expected to earn an A or B in all courses included in the program and must maintain a minimum cumulative 3.0 GPA (on a 4.0 scale) to graduate. The dissertation is graded on a Pass/Unsatisfactory basis and, therefore, is not included in the cumulative average. An accumulation of two C grades or one U grade will result in termination from the program.

Dissertation Advisor and Advisory Committee

Every student in the program must have a Dissertation Advisor and an Advisory Committee prior to being admitted to Candidacy. Students should select a dissertation advisor before the end of the second year of the program. Students and their dissertation advisor jointly determine the advisory committee. The Dissertation Advisor serves as Chair of the Advisory Committee and must be a member of the Graduate Faculty of Belk College of Business UNC Charlotte. The Advisory Committee must have at least four members, three of which are chosen by the student. Normally, the Dissertation Chair will be graduate faculty of the Belk College from the Departments of Business Information Systems and Operations Management, Management, or Marketing. Advisory Committee members must be members of the graduate faculty at UNC Charlotte or from other institutions or industry provided they have relevant expertise and background. Committee members should reflect both content and methods expertise needed for the student to complete the research.

Admission to Candidacy

The dissertation topic may be proposed after students have completed the required coursework. The proposal defense serves as the qualifying exam. Pursuant to Graduate School rules, doctoral students advance to candidacy after their Advisory Committee and the Dean of the Graduate School approve the dissertation topic. Further pursuant to Graduate School rules, candidacy must be achieved at least six months before the degree is conferred.

Dissertation

Students must complete and defend a dissertation based on a research program approved by the their Dissertation Advisor and Advisory Committee which results in a high-quality, original, and substantial piece of research. Students must orally present and defend the dissertation before the Advisory Committee in a defense that is open to the University community. A copy of the dissertation must be made available to the Graduate Faculty of the Belk College of Business at least three weeks prior to the public defense. While the defense is open to the University community, the deliberations of the Advisory Committee are held in Executive Session. The dissertation is graded on a Pass/Unsatisfactory basis by the Advisory Committee and the Dean of the Graduate School.

The dissertation defense is the final examination. It is a Graduate School requirement that students who fail the final examination twice are terminated from the program.

Residency Requirement

The DBA is a cohort-based program offered in an executive format. Normally students must enroll for nine credit hours during each semester of the regular academic year (i.e., fall and spring). Students may petition the Program Director for permission to enroll in less than nine semester hours in cases of hardship or other emergencies. It is a Graduate School requirement that a student must enroll in at least 18 total credit hours of Dissertation Research in order to graduate from the program.

Students that have completed all degree requirements, including the Dissertation Defense, may enroll once in GRAD 9999 (Doctoral Graduate Residency Credit) in order to meet Graduate School Residency requirements.

Time Limit for Degree Completion

Students are allowed a maximum of eight calendar years from formal admission to the DBA program to complete the program successfully.

Application for Degree

Students should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Ph.D. in Business Administration

Graduate Program

phd-business.charlotte.edu

The Ph.D. in Business Administration is a research-oriented program designed to prepare graduates for teaching and research careers in academia. The program includes core courses covering all business specialties combined with an in-depth study in both theoretical and empirical aspects. Students also receive training in pedagogy. Students are expected to demonstrate mastery of the existing body of knowledge and to develop new knowledge through original independent research. With the educational background provided by the program, graduates are qualified for tenure-track professor positions at both national and international research and teaching universities and other educational institutions.

Admission Requirements

All applicants seeking admission into the Ph.D. in Business Administration must fulfill the University's general requirements for graduate admission at the Ph.D. level. Additional requirements for admission into the program are listed below.

1) A baccalaureate or master's degree in Business, Economics, or a related field with a minimum undergraduate GPA of 3.5 (A=4.0) overall. In the case a candidate presents a master's degree at application, a minimum graduate GPA of 3.25 (A=4.0) on all graduate coursework is required.
2) A GMAT score of at least 650 or GRE scores with scores on the quantitative section of at least 700 and on the verbal section of at least 500.
3) For non-native speakers of English that do not hold degrees from a U.S. university, a score of 557 on the paper-based TOEFL, or 85% on the MELAB.
4) Non-native speakers of English may be required, at the discretion of the Graduate School or the Program Director for the Ph.D. in Business Administration, to enroll in English as a Second Language (ESL) courses at the English Language Training Institute.
5) Three positive letters of recommendation, one of which must be from a former professor.
6) A Statement of Purpose from the applicant explaining why they wish to pursue a Ph.D. in Business Administration and why they wish to study the specific area to which they are applying.
7) To ensure their preparation for doctoral coursework, students may be required to take additional undergraduate or graduate courses, as determined by the Ph.D. in Business Administration Program Committee and the Program Director. Such courses will be specified at the time of admission into the program and may include courses in finance, economics, accounting, marketing, management, operations management, management information systems, mathematics, or statistics.

Students are admitted to the program by the Dean of the Graduate School based on the recommendation of the Belk College of Business Doctoral Program Director, in consultation with the Belk College of Business Doctoral Program Committee. Recommendations are based on the assessments of the Program Director and the Program Committee of the candidate's ability to complete the program, as supported by the application materials. The Program Director, in consultation with the Program Committee, may waive certain requirements if they judge the candidate to be capable of completing the program. If there are more candidates than can be accommodated, candidates are recommended in order of their perceived ability, promise of success, and suitability to the program.

Degree Requirements

The degree of Doctor of Philosophy in Business Administration is awarded for completion of scholarly research that advances knowledge in the field of research. Evidence of this is demonstrated by a successful dissertation defense. Additionally, recipients of this degree must demonstrate mastery of the body of knowledge within the field and potential for success in future teaching and research.

Students that enter the program must work with the Graduate Program Director to develop a Plan of Study during their first two semesters in the program. This Plan of Study determines the exact coursework that the student must meet in order to be eligible to take the Qualifying Examination. The Plan of Study must meet all Graduate School and Belk College of Business requirements. The Graduate School requires that any student earning a Ph.D. must complete at least 72 post-baccalaureate credit hours, including at least 18 hours of dissertation credit. Some of these graduate credit hours may include courses taken while enrolled in other graduate programs. It is a Belk College of Business requirement that any program of study within the Ph.D. in Business Administration must contain at least 42 credit hours of doctoral coursework, regardless of other graduate hours that the student may have previously earned. These 42 credit hours are in addition to the minimum 18 hours of dissertation credit that the Graduate School requires. The Plan of Study must contain a minimum of 33 credit hours in finance and economics courses and a minimum of 9 credit hours in research support courses.

In addition to the general requirements above, if a student enters the program with only a Bachelor's degree, the Plan of Study must include an additional 30 credit hours of coursework. This coursework must be taken at the graduate level and will generally include courses that are part of the Master of Accountancy, Master of Business Administration, Master of Science in Economics, or Master of Science in Mathematical Finance programs. These 30 credit hours of additional coursework are subject to the approval of the Graduate Program Director.

To ensure that all students are ready for doctoral courses in Business Administration, the program has two distinct sets of prerequisites. First, students entering the program must either demonstrate or attain proficiency in each of the business specialties. Second, students must also demonstrate or attain mathematical proficiency. Students entering the program will be evaluated for these proficiencies by the Graduate Program Director. If a student is found to be deficient, then the Plan of Study must include appropriate courses, as determined by the Graduate Program Director, from the Business Core and Mathematical prerequisites listed below. These courses are in addition to the finance, economics, and research support courses.

Business Core Courses

To ensure their preparation for doctoral level coursework in all business specialties, students must demonstrate proficiency in the Business Core. Students may satisfy this requirement either by taking the following courses or by having previously taken equivalent courses:

MBAD 6152 - Financial Management (3)
MBAD 6194 - Global Strategic Management (3)
MBAD 6270 - Marketing Management (3)

Students who lack sufficient preparation in accounting, economics, or information systems may, at the discretion of the Graduate Program Director, be required to complete one or more 5000-level business courses in these disciplines. For the 6000-level courses listed above, only graduate courses may count as equivalent courses. However, students may, at the discretion of the Graduate Program Director, be permitted to take other 6000-level or higher-level courses in place of those listed above if the student's background indicates that this would benefit the student.

Prerequisite Mathematics Courses

Finance and economics are mathematically intensive fields. To ensure that students are prepared for doctoral level coursework, they are required to have had, at the graduate or undergraduate level, the equivalent of the following courses:

MATH 1241 - Calculus I (3)
MATH 1242 - Calculus II (3)
MATH 2164 - Matrices and Linear Algebra (3)
MATH 2241 - Calculus III (3)
MATH 3122 - Probability and Statistics I (3)
MATH 3123 - Probability and Statistics II (3)

Students lacking these mathematics courses will generally be allowed to take those courses at either the graduate or undergraduate level. At the Graduate Program Director's discretion, a student may be permitted to take combined courses to meet multiple prerequisites.

Although unlikely, it is possible that a student may enter the program without having taken a specific prerequisite or business core course but has, nevertheless, acquired the same skill and technical abilities that the course would convey. In such cases, the Graduate Program Director may waive the course.

Students who lack strong computer programming skills may be advised to take programming courses offered by the College of Computing and Informatics. Specifically, the Graduate Program Director may advise a student to take ITSC 1212 (Introduction to Computer Science I) or other similar courses after reviewing the student's background and prior programming experience.

Finance and Economics Courses (33 credit hours)

The Plan of Study must consist of a minimum of six courses in finance and five courses in economics. Typically, these courses are:

BPHD 8100 - Microeconomic Theory I (3)

BPHD 8110 - Microeconomic Theory II (3)
BPHD 8120 - Econometrics I (3)
BPHD 8130 - Econometrics II (3)
BPHD 8140 - Econometrics III (3)
BPHD 8200 - Financial Economic Theory I (3)
BPHD 8210 - Investments and Portfolio Theory (3)
BPHD 8220 - Financial Economic Theory II (3)
BPHD 8230 - Theory of Corporate Finance (3)
BPHD 8240 - Derivatives (3)
BPHD 8650 - Advanced Seminar in Finance (3)

Two of these courses, BPHD 8200 and BPHD 8240, are cross-listed with courses that are part of the Master of Science in Economics and the Master of Science in Mathematical Finance programs. Ph.D. students in these cross-listed courses will be required to complete the master's level requirements of the course and in addition, will be required to take separate exams, prepare a research paper, and complete additional readings. Students that have taken those equivalent courses may, at the discretion of the Graduate Program Director, substitute additional sections of BPHD 8650 on their Plan of Study for those courses. In addition, the Graduate Program Director may require a student to list BPHD 8650 more than once in their Plan of Study as topics change. Exceptions to the economics courses may only be made with the permission of the Ph.D. Program Director.

Research Support Courses (9 credit hours)

The Ph.D. in Business Administration requires that students have at least nine hours of research support courses in their Plan of Study. These research support courses must come from the Department of Mathematics and Statistics or Department of Economics. Students are required to choose three courses from the following:

ECON 6257 - Applied Computational Economics (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)
MATH 8203 - Stochastic Calculus for Finance (3)
MATH 8204 - Numerical Methods for Financial Derivatives (3)

Some of the research support courses are cross-listed with courses used in the M.S. in Mathematical Finance program. Students that have taken those equivalent courses may, at the discretion of the Graduate Program Director, take other mathematics, statistics, economics, finance or related courses in place of the courses specified above.

Elective Courses (12 credit hours)

In addition to the 60 credit hours of required coursework indicated above, students are required to complete 12 elective credit hours from the following:

- Additional course offering(s) with different topics of BPHD 8650 - Advanced Seminar in Finance (3)
- Additional Research Support Courses
- Additional Dissertation Credits

As an exception, students may, at the discretion of their Graduate Program Director, be permitted to use a course taken while enrolled in another graduate program to count toward the elective credit hours.

Dissertation Credits (18 credit hours)

Students are required to complete at least 18 hours of dissertation credits.

BPHD 8999 - Doctoral Dissertation Research

Degree Total = 72 Credit Hours

Grade Requirements

Students are expected to earn an A or B in all courses included in the program of study and must have at least a 3.0 GPA to graduate. The dissertation is graded on a Pass/Unsatisfactory basis and, therefore, is not be included in the cumulative average. An accumulation of more than two marginal (C) grades will result in suspension of the student's enrollment in the program. If students earn a grade of U in any course, their enrollment in the program is suspended, and the student cannot take further coursework without being readmitted to the program. Readmission to the program requires approval of the Dean of the Graduate School upon the recommendation of the Program Director.

Teaching Mentor and Pedagogy Training

To ensure that graduates of the program are prepared for a career in both teaching as well as in research, a formal system of pedagogical training is required. Students that enter the program without prior teaching experience will be assigned a faculty Teaching Mentor and will be required to attend a teaching workshop. Most students entering the program will also initially be employed as teaching assistants. Normally after one year in the program students will begin to teach their own sections of undergraduate courses. The combination of mentoring, apprenticeship training through the teaching assistantships, formal pedagogy, and actual instructor experience will allow students in the program to develop their teaching skills along with their research skills.

Diagnostic Evaluation

Students entering the program will take a diagnostic evaluation at the end of their first full year in the program. The diagnostic examination will be administered by the Program Director, in consultation with the Program Committee. The format of the diagnostic examination will be determined by the Committee, but might consist of a review of the student's work in classes, a written exam, or an oral exam. The purpose of the diagnostic evaluation

will be to determine whether the student is making sufficient progress toward the degree. Students that are determined not to be making satisfactory progress toward the degree will be suspended from the program.

Dissertation Advisor and Advisory Committee

Every student in the program must have a Dissertation Advisor and an Advisory Committee prior to being admitted to Candidacy. The student should select a dissertation advisor before the end of the second year of residency. The student and the dissertation advisor jointly determine the advisory committee. The Dissertation Advisor serves as Chair of the Advisory Committee and must be a member of the Graduate Faculty of UNC Charlotte. Normally, the Dissertation Advisor for a student will be a member of the Department of Finance. A student may petition the Program Director to allow a member of another department within the Belk College, or a member of the Department of Mathematics and Statistics, to serve as their Dissertation Advisor. The advisory committee must have at least four members, three of which are chosen by the student. Normally, two members will be from finance and one from economics. A student may petition the Program Director to allow a member of another department within the Belk College, or a member of the Department of Mathematics and Statistics to serve on the Committee. The fourth member of the committee will be the Graduate Faculty representative to the Committee. That member will be appointed by the Dean of the Graduate School. All members of the Committee must be members of the UNC Charlotte Graduate Faculty.

Qualifying Examination

Upon completion of all required coursework on their Plan of Study, a student must take the Qualifying Examination. The Qualifying Examination is held twice per year. Students that have completed their Program of Study must take the qualifying examination the first time that it is offered. The Comprehensive Exam will be a written exam consisting of two four-hour sessions, administered on consecutive days. The intent of the Qualifying Examination is to test the student's mastery of the body of knowledge, and to demonstrate their familiarity with current research in the field. The qualifying exam will, therefore, cover topics addressed during doctoral coursework, seminars, and in the recent scholarly literature. The Qualifying Examination will be written and graded by an Examination Committee appointed by the Program Director. This committee will normally consist of faculty from finance, economics, and research support fields.

If a student fails the Qualifying Examination at the first attempt, they must retake the exam the next time it is offered. During the interim period, the student may be required to retake courses in which, in the eyes of the Examination Committee, they have a deficiency. It is Graduate School policy that a student who fails the Qualifying Examination twice will be terminated from the program.

Admission to Candidacy

The dissertation topic may be proposed after the student has passed the Qualifying Examination. Pursuant to Graduate School rules, a doctoral student advances to candidacy after the student's Advisory Committee and the Dean of the Graduate School approve the dissertation topic. Further pursuant to Graduate School rules, candidacy must be achieved at least six months before the degree is conferred.

Dissertation

The student must complete and defend a dissertation based on a research program approved by the student's Dissertation Advisor and Advisory Committee which results in a high-quality, original and substantial piece of research. The student must orally present and defend the dissertation before the Advisory Committee in a defense that is open to the University Community. A copy of the dissertation must be made available to the Graduate Faculty of the Belk College at least three weeks prior to the public defense. While the defense is open to the University Community, the deliberations of the Advisory Committee are held in Executive Session. The dissertation will be graded on a pass/unsatisfactory basis by the Advisory Committee and the Dean of the Graduate School.

The dissertation defense is the final examination. It is a Graduate School requirement that a student that fails the final examination twice will be terminated from the program.

Residency Requirement

The Ph.D. in Business Administration is a full-time program. Normally students must enroll for at least nine credit hours during each semester of the regular academic year (i.e., Fall and Spring) and at least six hours in the summer semester. Students may petition the Program Director for permission to enroll in less than nine credit hours (six credit hours in summer) in cases of hardship or other emergencies. Students that have passed their Qualifying Examinations must enroll in BPHD 8999 (Doctoral Dissertation Research) for at least 9 hours during the fall and spring semester and 6 hours during the summer semester. It is a Graduate School requirement that a student must enroll in at least 18 total hours of Dissertation Research in order to graduate from the program.

Students that have completed all degree requirements, including the Dissertation Defense, may enroll once in GRAD 9999 (Doctoral Degree Graduate Residency

Credit) in order to meet Graduate School Residency requirements.

Assistantships
A number of graduate assistantships are available each year for qualified applicants. The Graduate School also has a limited number of fellowships available for highly qualified applicants.

Transfer Credit
Only courses with grades of A or B from an appropriate doctoral program at an AACSB accredited school may be accepted for transfer credit. Transfer credit must be approved by the Program Director, and cannot exceed the limit set by the Graduate School.

Time Limit for Degree Completion
The student must achieve candidacy for the Ph.D. degree within six years of enrolling in the program, and the student must complete all degree all requirements within nine years of enrolling in the program. All courses listed on the Plan of Study must also meet Graduate School time requirements.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Master of Business Administration (MBA)

Graduate Program
mba.charlotte.edu

The primary objective of graduate study in business is to develop candidates for leadership positions in complex organizations. The MBA program focuses on developing the expertise to lead, influence, and persuade others through effective written and spoken communications; the ability to approach complex problems both systematically and imaginatively; the confidence to make decisions in the face of imperfect information, competing objectives, and technological change; the insight to recognize the ethical dimensions of organizational and individual decisions; the sensitivity to recognize that organizational decisions involve teamwork and consensus-building across diverse groups of individuals; and the awareness that business represents an inherently multinational enterprise that exists without geographical or cultural boundaries.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Business Administration:

- A generally satisfactory undergraduate record from a college or university accredited by an accepted accredited body
- A satisfactory score on the Graduate Management Admission Test (GMAT) or Graduate Record Exam (GRE)
- A full resume or a description of significant work experience
- A satisfactory score on the TOEFL or IELTS examination for students whose native language is not English or that have not received a degree from a U.S. institution

GMAT/GRE Waiver
Option A (Standard Waiver)
Candidates must possess at least 3 years of professional or military experience with increasing levels of responsibility (significant leadership experience is a plus), a cumulative undergraduate or graduate (must have at least 9 hours of earned graduate credit) GPA of 3.0 or above from an accredited program and, if relevant, institution.

Option B (Quantitative Coursework Waiver)
Candidates must possess at least 3 years of professional or military experience with increasing levels of responsibility (significant leadership experience is a plus), or be able to demonstrate preparedness in quantitatively-oriented coursework (must have at least a 3.25 GPA in five of the following six courses: Microeconomics, Macroeconomics, Managerial Accounting, Financial Accounting, Statistics, and Calculus).

Candidates who meet the experience requirement, but do not have enough (or any) quantitative coursework to have their quantitative competencies assessed, must complete modules through MBAMath.com (or other approved online providers) with scores of 80% in each required module among the 5 areas (economics, finance, accounting, statistics and spreadsheets).

Degree Requirements
The MBA degree program consists of 36 graduate credit hours, including a Core component and a Concentration/Elective component. Up to 6 credit hours of coursework may be transferred from an AACSB-accredited institution or equivalent, based on a recommendation of the relevant academic department, approval of the Director of the MBA program, and approval of the Graduate School. Necessary preparatory work is determined during the admissions process, and prerequisite courses to meet the specific need are

available. All students in the program must meet the Graduate School's requirements for a Master's Degree.

Required Core Courses (24 credit hours)
MBAD 6101 - Ethical Leadership (3)
MBAD 6112 - Economics of Business Decisions (3)
MBAD 6131 - Financial and Managerial Accounting for MBAs (3)
MBAD 6141 - Operations Management (3)
MBAD 6152 - Financial Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6194 - Global Strategic Management (3)*
MBAD 6270 - Marketing Management (3)

**MBAD 6194 serves as the required capstone course for the MBA program. Thus, all core courses should be completed prior to taking MBAD 6194.*

Concentration Courses (12 credit hours)
Complete 12 credit hours of courses specified for a concentration. Students may enroll in these courses as soon as they complete the prerequisites for each course. MBAD 6890 and MBAD 7090 may be included in a concentration with permission of the MBA Program Director and the related department.

Applied Investment Management Concentration
Required Course(s)
MBAD 5158 - Student Managed Investment Fund I (3)
MBAD 5159 - Student Managed Investment Fund II (3)
MBAD 6153 - Investment Management (3)

Elective Course(s)
Select one of the following:
MBAD 6155 - Multinational Financial Management (3)
MBAD 6156 - Commercial Bank Management (3)
MBAD 6157 - Advanced Corporate Finance (3)
FINN 6210 - Financial Elements of Derivatives (3)

Business Analytics Concentration
Required Course(s)
MBAD 6201 - Business Intelligence and Analytics (3)
MBAD 6122 - Decision Modeling and Analysis (3)
MBAD 6211 - Advanced Business Analytics (3)

Elective Course(s)
Select one of the following:
MBAD 6202 - Digitization of Business Processes (3)
MBAD 6203 - Information Systems Economics, Strategy and Policy (3)
MBAD 6204 - Management of Cybersecurity and Privacy (3)
MBAD 6207 - Business Project Management (3)
MBAD 6208 - Supply Chain Management (3)
MBAD 6272 - Marketing Analysis and Decision-Making (3)
MBAD 6281 - Pricing and Positioning Strategy (3)
ECON 6112 - Graduate Econometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)

Business Finance Concentration
Required Course(s)
MBAD 6153 - Investment Management (3)
MBAD 6157 - Advanced Corporate Finance (3)

Elective Course(s)
Select two of the following:
MBAD 6151 - Financial Institutions and Markets (3)
MBAD 6154 - Applied Business Finance (3)
MBAD 6155 - Multinational Financial Management (3)
MBAD 6156 - Commercial Bank Management (3)

Energy Concentration
Required Course(s)
EMGT 5961 - Introduction to Energy Systems (3)
MBAD 6962 - Energy Markets (3)

Elective Course(s)
Select one of the following:
ECON 5181 - Energy and Environmental Economics (3)
EMGT 5963 - Energy Systems Planning (3)
EMGT 5964 - Case Studies in the Energy Industry (3)

And a different one from the following:
ECON 5181 - Energy and Environmental Economics (3)
EMGT 5963 - Energy Systems Planning (3)
EMGT 5964 - Case Studies in the Energy Industry (3)
EMGT 6901 - Advanced Project Management (3)
EMGT 6930 - Capital Cost Estimating (3)
FINN 6210 - Financial Elements of Derivatives (3)
MBAD 6157 - Advanced Corporate Finance (3)

Entrepreneurship and Corporate Venturing
Required Course(s)
MBAD 3300 - Entrepreneurial Decisions (3)

Elective Course(s)
Select three of the following:
MBAD 6191 - Entrepreneurial Strategy (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6279 - Design Thinking and Innovation (3)
MBAD 6280 - Innovation and Change Strategy (3)
MBAD 6302 - Evaluating Entrepreneurial Opportunities (3)
MBAD 6304 - Entrepreneurial Organizing (3)
MBAD 6305 - Entrepreneurship and Uncertainty (3) -
MBAD 6306 - Corporate Entrepreneurship (3)
MBAD 6309 - Business Models and Business Plans (3)

Financial Institutions/Commercial Banking Concentration
Required Course(s)
MBAD 6153 - Investment Management (3)
MBAD 6156 - Commercial Bank Management (3)
MBAD 6157 - Advanced Corporate Finance (3)

Elective Course(s)
Select one of the following:
MBAD 6151 - Financial Institutions and Markets (3)
MBAD 6155 - Multinational Financial Management (3)
FINN 6210 - Financial Elements of Derivatives (3)

Global Business Concentration
Required Course(s)
MBAD 6193 - Global Business Environment (3)
MBAD 6197 - International Business Management (3)
Plus one course involving MBA-approved international study or travel (3)

Elective Course(s)
Select one of the following:
MBAD 6275 - Global Marketing Strategy (3)
MBAD 6155 - Multinational Financial Management (3)

Information and Technology Management Concentration
Required Course(s)
Select two (or three) of the following:
MBAD 6202 - Digitization of Business Processes (3)
MBAD 6204 - Management of Cybersecurity and Privacy (3)
MBAD 6207 - Business Project Management (3)

Elective Course(s)
Select two (or one if three required courses are selected) of the following:
MBAD 6122 - Decision Modeling and Analysis (3)
MBAD 6201 - Business Intelligence and Analytics (3)
MBAD 6203 - Information Systems Economics, Strategy and Policy (3)
MBAD 6208 - Supply Chain Management (3)

Innovation and Growth Strategies Concentration
Elective Course(s)
Select three of the following:
MBAD 6271 - Consumer Behavior and Strategy (3)
MBAD 6273 - Product and Brand Strategy in the Connected World (3)
MBAD 6279 - Design Thinking and Innovation (3)
MBAD 6280 - Innovation and Change Strategy (3)

Plus one of the following:
MBAD 6272 - Marketing Analysis and Decision-Making (3)
MBAD 6277 - Social Media Marketing and Analytics (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6309 - Business Models and Business Plans (3)

Note: MBAD 6890 (Directed Individual Study) and MBAD 7090 (Special Topics in Business) may be included in the concentration with permission of both the MBA Program Director and Department Chair.

Management Concentration
Elective Course(s)
Select four of the following:
MBAD 6162 - Leadership in Organizations (3)
MBAD 6163 - Managing People for Competitive Advantage (3)
MBAD 6164 - Executive Communication (3)
MBAD 6165 - Negotiation and Conflict Management (3)
MBAD 6191 - Entrepreneurial Strategy (3)
MBAD 6192 - Business Ethics and Corporate Responsibility (3)
MBAD 6193 - Global Business Environment (3)
MBAD 6197 - International Business Management (3)
MBAD 6207 - Business Project Management (3)

Marketing Concentration
Elective Course(s)
Select four of the following:
MBAD 6271 - Consumer Behavior and Strategy (3)
MBAD 6272 - Marketing Analysis and Decision-Making (3)
MBAD 6273 - Product and Brand Strategy in the Connected World (3)
MBAD 6274 - Advertising and Promotion Strategy (3)
MBAD 6275 - Global Marketing Strategy (3)
MBAD 6276 - Consumer Analytics (3)
MBAD 6277 - Social Media Marketing and Analytics (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6279 - Design Thinking and Innovation (3)
MBAD 6280 - Innovation and Change Strategy (3)
MBAD 6281 - Pricing and Positioning Strategy (3)
MBAD 6282 - Marketing of Sports (3)

Marketing Analytics Concentration
Elective Course(s)
Select four of the following:
MBAD 6272 - Marketing Analysis and Decision-Making (3)
MBAD 6276 - Consumer Analytics (3)
MBAD 6277 - Social Media Marketing and Analytics (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6283 - Mobile Marketing and Analytics (3)

Quantitative Methods for Business Concentration
Required Course(s)
ECON 6112 - Graduate Econometrics (3)
MBAD 6122 - Decision Modeling and Analysis (3)

Elective Course(s)
Select two of the following:
ECON 6217 - Advanced Microeconometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)
ITCS 6500 - Complex Adaptive Systems (3)
MBAD 6211 - Advanced Business Analytics (3)
MBAD 6272 - Marketing Analysis and Decision-Making (3)

Real Estate Finance and Development Concentration
Required Course(s)
MBAD 6158 - Real Estate Finance and Investment (3)
MBAD 6159 - Real Estate Development (3)

Elective Course(s)
Select two of the following:
MBAD 6160 - Real Estate Capital Markets (3)
MBAD 6258 - Site Feasibility Analysis (3)
MBAD 6259 - Applied Real Estate Development (3)
ECON 6250 - Advanced Urban and Regional Economics (3)
MSRE 6102 - International Real Estate Study Tour (3)
MSRE 6120 - Real Estate Law (1.5)
MSRE 6130 - Site Planning (1.5)
MSRE 6220 - Financial Analysis of Real Estate Investments (1.5)
MSRE 6230 - Construction Management (1.5)

Supply Chain Management Concentration
Required Course(s)
MBAD 6122 - Decision Modeling and Analysis (3)
MBAD 6208 - Supply Chain Management (3)

Elective Course(s)
Select two of the following:
MBAD 6201 - Business Intelligence and Analytics (3)
MBAD 6207 - Business Project Management (3)
ECON 6112 - Graduate Econometrics (3)

Student Structured Concentration
Students may propose a 12 credit hour concentration in a significant area of interest for approval by the Director of the MBA program. This concentration may include graduate courses from other programs within the University with approval of the MBA Program Director and the related department.

Degree Total = 36 Credit Hours

Dual Master's Degree Program
MBA candidates interested in combining their business degree with another graduate degree may pursue this option by applying to and being accepted by each program separately. Students must formally propose their dual degree intentions with the Graduate School. A significant time savings may be yielded as a result of the synergy between combined programs. Popular dual degree options for MBA candidates include the Master of Health Administration, Master of Public Administration, Master of Accountancy, Master of Urban Design, and Master of Architecture.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Assistantships
A limited number of assistantships are available each year. In order to be competitive, applications should be submitted by March 15. Additional information is available in the MBA office and the Graduate School website.

Advising
Academic Advising is provided by Associate Director of Graduate Student Services and the Director of the MBA Program.

Transfer Credit
Up to six hours of appropriate graduate credit may be accepted for transfer from another AACSB-accredited (or equivalent) MBA program. Only courses where grades of B or above have been earned will be considered. Approval of the Director of the MBA Program and the Graduate School is also required. All other Graduate School policies regarding transfer credit apply.

Program Certifications/Accreditation
The MBA Program and all degree and certificate programs offered by the Belk College of Business are accredited by the Association to Advance Collegiate Schools of Business (AACSB-International).

Master of Business Administration (MBA) / Master of Health Administration (MHA) Dual Degree

This dual degree program allows students to earn both a Master of Business Administration (MBA) degree from the Belk College of Business and a Master of Health Administration (MHA) degree from the College of Health and Human Services.

Applicants might be offered admission into only the MHA or MBA instead of the dual program. Similarly, students admitted into the dual program may opt to matriculate into only the MHA or MBA program. Students who have matriculated into either the MHA or MBA program who desire to add the dual degree must apply and gain admission to the dual degree no later than the end of their first semester of matriculation into either program.

Degree Requirements

The combined program requires 66 credit hours of coursework.

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HADM 6104 - Health and Disease (3)
HADM 6108 - Decision Analysis in Healthcare (3)
HADM 6120 - Health Economics (3)
HADM 6128 - Human Resources Management (3)
HADM 6134 - Quality and Outcomes Management in Healthcare (3)
HADM 6138 - Healthcare Finance (3)
HADM 6142 - Health Policy Development (3)
HADM 6145 - Organizational Behavior in Healthcare (3)
HADM 6146 - Information Resources Management (3)
HADM 6150 - Health Law and Ethics (3)
HADM 6154 - Strategic Management of Health Services Organizations (3)
HADM 6400 - Health Internship Project (3)
MBAD 6112 - The Economics of Business Decisions (3)
MBAD 6131 - Financial and Managerial Accounting for MBAs (3)
MBAD 6141 - Operations Management (3)
MBAD 6152 - Financial Management (3)
MBAD 6194 - Global Strategic Management (3)
MBAD 6270 - Marketing Management (3)
MBAD/HADM - Business/Health Administration Elective (3)
MBAD/HADM - Business/Health Administration Elective (3)
MBAD/HADM - Business/Health Administration Elective (3)

Dual Degree Total = 66 Credit Hours

MBA PLUS Post-Master's Certificate

The MBA PLUS Post-Master's Certificate program provides an opportunity for graduates of AACSB-accredited MBA programs to broaden and update their business education. As business conditions, tools, and techniques change rapidly, a major way of staying at the forefront of knowledge is through additional university education. The MBA PLUS Certificate makes courses in the Belk College's MBA Concentrations available to persons who already have MBA degrees.

Admission Requirements

Applicants must satisfy the general requirements established by the Graduate School for admission to a graduate certificate program. Applicants must provide one official transcript indicating the awarding of an MBA degree from an AACSB-accredited institution or equivalent, one official transcript indicating the awarding of an accredited bachelor's degree, along with the Graduate application and application fee. (Graduates from the MBA program at UNC Charlotte are not required to send an official transcript.) Applicants will not be required to retake the GMAT.

Certificate Requirements

The MBA PLUS Certificate requires completion of 12 or more credit hours of 6000-level courses. At least 9 credit hours must be elective courses. One 3-credit hour course may be a repeat of a course previously taken. A student may repeat more courses, but only one such repeated course will be counted toward the certificate. The 12-credit hour elective course requirement of the MBA PLUS corresponds to the 12-credit hour concentrations in the MBA program.

It is expected that most students will use their 12 credit hours or more to gain a concentration in a particular functional area of interest. However, a broader program that draws from a number of areas may be pursued.

Transfer credits are not accepted in the MBA PLUS Certificate program.

Certificate Total = 12 Credit Hours

Grade Requirements

To receive the certificate, students must complete all courses with a grade of B or above within five years from the time of enrollment in the first certificate course.

Graduate Certificate in Business Analytics

The Graduate Certificate in Business Analytics provides students with a foundation in business analytics. The aim of the certificate is to satisfy the large and rapidly increasing demand in the marketplace for data-driven decision making in business. Students learn how to understand and apply data analytics techniques in business decisions. Demand for these skills has been driven predominantly by exponential growth in the generation of unstructured data by consumers -- often referred to as the "Big Data Revolution." Students considering graduate study in business analytics learn how to turn abstract data into important information that can be used in business decisions.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Business Analytics:

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- GPA of at least 2.75 (based on a 4.0 scale) on all previous coursework completed beyond high school (secondary school)
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all attempted college coursework
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Certificate Requirements

The Graduate Certificate in Business Analytics requires the completion of 12 credit hours of 6000-level courses in business and marketing analytics. Transfer credits are not accepted into the Graduate Certificate in Business Analytics program.

Core Courses (6 credit hours)

MBAD 6201 - Business Intelligence and Analytics (3)
MBAD 6276 - Consumer Analytics (3)

Elective Courses (6 credit hours)

Select two of the following:
MBAD 6122 - Decision Modeling and Analysis (3)
MBAD 6207 - Business Project Management (3)
MBAD 6211 - Advanced Business Analytics (3)
MBAD 6212 - Enterprise Systems (3)
MBAD 6213 - Applied Healthcare Business Analytics (3)
MBAD 6272 - Marketing Analysis and Decision-Making (3)
MBAD 6277 - Social Media Marketing and Analytics (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6283 - Mobile Marketing and Analytics (3)
MBAD 7090 - Special Topics in Business (3) *(Big Data Analytics for Competitive Advantage)*

Certificate Total = 12 Credit Hours

Grade Requirements

Students must earn a grade of B or above in all four courses that make up the certificate program.

Graduate Certificate in Entrepreneurship and Innovation

The Graduate Certificate in Entrepreneurship and Innovation provides students with a strong foundation in entrepreneurship and innovation. The certificate aims to satisfy the increasing societal demand for skill sets related to entrepreneurship and innovation. Entrepreneurship serves as the path through which innovations and improvements to the overall quality of life within society come to fruition. In doing so, entrepreneurship and innovation drive economic development.

Additionally, the Graduate Certificate in Entrepreneurship and Innovation allows students considering graduate study in the Master of Business Administration (MBA) program and other graduate study in entrepreneurship to explore material prior to formally committing to a full graduate degree program. All certificate courses can then be transferred into the MBA program at UNC Charlotte. However, admission to the MBA program requires a separate application and satisfaction of MBA program admission requirements.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Entrepreneurship and Innovation:

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- GPA of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college course work attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Certificate Requirements

The Graduate Certificate in Entrepreneurship and Innovation requires completion of 12 credit hours (4 courses) of 6000-level courses in entrepreneurship and innovation. Transfer credit is not accepted into the Graduate Certificate in Entrepreneurship and Innovation program.

Core Courses (6 credit hours)

MBAD 6280 Innovation and Growth Strategy (3)
MBAD 6309 Business Models and Business Plans (3)

Elective Courses (6 credit hours)

Select two of the following:

MBAD 5300 - Entrepreneurial Decisions (3)
MBAD 6191 - Entrepreneurial Strategy (3)
MBAD 6273 - Product and Brand Strategy in the Connected World (3)
MBAD 6278 - Innovation Analytics (3)
MBAD 6279 - Design Thinking and Innovation (3)
MBAD 6302 - Evaluating Entrepreneurial Opportunities (3)
MBAD 6304 - Entrepreneurial Organizing (3)
MBAD 6305 - Entrepreneurship and Uncertainty (3) -
MBAD 6306 - Corporate Entrepreneurship (3)

Certificate Total = 12 Credit Hours

Grade Requirements
Students must earn a grade of B or above in all four courses that make up the certification program.

ECONOMICS

- M.S. in Economics
  - Applied Economic Analysis
  - Financial Management
  - Quantitative Financial Economics
  - Quantitative Methods in Economics
  - Urban Economics and Real Estate
- M.S. in Economics/M.S. in Mathematical Finance Dual Degree *(see the Mathematical Finance section)*
- M.S. in Economics/M.Sc. in Economics and Business Administration Dual Degree *(in conjunction with the Copenhagen Business School) (See the Global Business section)*
- Graduate Certificate in Applied Econometrics

Department of Economics
belkcollege.charlotte.edu/departments/economics

Graduate Program
msecon.charlotte.edu

M.S. in Economics

The Master of Science (M.S.) in Economics degree program features a curriculum that is flexible yet thorough in its approach to theoretical training and applied coursework. The program offers four concentrations in: (1) Quantitative Methods in Economics, (2) Quantitative Financial Economics, (3) Financial Management, and (4) Applied Economic Analysis. Students completing this program are prepared for analytical and management positions that require the integration of economic analysis and advanced quantitative methods. Employment opportunities for economists with a master's degree exist in both the public and private sectors. In addition, students with a master's degree may choose to pursue additional graduate education leading to a doctoral degree in Economics, Finance, or Public Policy.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Economics:

- Undergraduate coursework that includes: Calculus, Econometrics (or equivalent), Intermediate Macroeconomic Theory, Intermediate

Microeconomic Theory, and Mathematical Economics (preferred) *(Students missing some of these courses can still be admitted with permission of Graduate Program Director)*

- A satisfactory score on the aptitude portions of the Graduate Record Examination (GRE) *(The Graduate Management Aptitude Test (GMAT) may be substituted for the GRE with permission of the Graduate Program Director)*

GRE Waiver

The GMAT/GRE requirement may be waived for applicants who meet the following criteria:

- **General Applicants** – 3.0 or above undergraduate GPA, with grades of A or B in Economics, Math, and Statistics courses, or more than one year of relevant work experience
- **Early Entry Applicants** - 3.2 or above undergraduate GPA, with grades of A or B in Economics, Math, and Statistics courses
- **Graduate Certificate in Applied Econometrics Students** – completion of a minimum of two courses with grades of B or above, and a graduate GPA of 3.0 or higher

The waiver must be requested from the M.S. in Economics Graduate Program Director when submitting the completed application. All GMAT/GRE waivers are at the discretion of the M.S. in Economics Graduate Program Director. If candidates are unable to secure the GMAT/GRE waiver, they will be required to submit official GMAT/GRE test scores in their M.S. Economics application.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements

The program leading to the Master of Science degree in Economics requires at least 30 hours of graduate credit, with a maximum of six hours of transfer credit accepted from an accredited institution. (Credit applied toward an awarded graduate degree will not be accepted as transfer credit.) Courses taken at other accredited institutions after enrollment may receive residence credit if approved by the department and the Dean of the Graduate School. No more than two grades of C are permitted in the program and at least 18 credit hours must be completed before admission to candidacy. A GPA of at least 3.0 is required to graduate. The program is organized into three curriculum components:

1) Core Curriculum in economic theory and quantitative methods
2) Thesis or Research Project
3) Concentration selected from one of the four described below

Core Courses (12 credit hours)

ECON 6201 - Advanced Macroeconomic Theory (3)
ECON 6202 - Advanced Microeconomic Theory (3)
ECON 6112 - Graduate Econometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)

Concentrations

Quantitative Methods in Economics Concentration

The Concentration in Quantitative Methods in Economics is designed for students who want to study quantitative methods in detail. It is an ideal option for those students interested in applying quantitative modeling and methods for economic analysis in their chosen field or pursuing an Economics Ph.D. after completion of the M.S. in Economics program. This concentration can be completed in one and a half years of study.

Students in this concentration must complete the core curriculum and the thesis or research project for the M.S. in Economics. In addition, they must complete:

ECON 6217 - Advanced Microeconometrics
ECON 6219 - Financial Econometrics

And two of the following:
ECON 6203 - Financial Economic Theory
ECON 6206 - Game Theory and Experiments
ECON 6235 - Monetary and Financial Theory
ECON 6257 - Applied Computational Economics

OR a combination of the above courses and approved elective courses that total 6 credit hours

Quantitative Financial Economics Concentration
The Concentration in Quantitative Financial Economics is designed for students interested in pursuing careers in portfolio management or financial risk management. This concentration can also provide an excellent foundation for students who wish to pursue additional graduate study leading to a doctoral degree in Finance. The concentration can be completed in one and a half years of study.

Students in this concentration must complete the core curriculum and the thesis or research project for the M.S. in Economics. In addition, they must complete:

ECON 6203 - Financial Economic Theory (3)
ECON 6219 - Financial Econometrics (3)
FINN 6210 - Financial Elements of Derivatives (3)

And one of the following:
FINN 6211 - Fixed Income Securities and Credit Risk (3)
ECON 6235 - Monetary and Financial Theory (3)
An approved elective course

Urban Economics and Real Estate Concentration
The Concentration in Real Estate and Urban Economics is designed for students who want to study real estate finance and urban economics in detail. It is an ideal option for those students interested in applying economic analysis to the area of real estate finance or pursuing an Economics or Real Estate Ph.D. after completion of the M.S. in Economics program. This concentration can be completed in one and a half years of study.

Students in this concentration must complete the core curriculum and the thesis or research project for the M. S. in Economics. In addition, they must complete:

MSRE 6158 - Real Estate Finance and Investment (3)
MSRE 6160 - Real Estate Capital Markets (3)
MSRE 6238 - Real Estate and Urban Economics (3)

And one of the following:

MSRE 6102 - International Real Estate Study Tour (3)
MSRE 6220 - Financial Analysis of Real Estate Investments (3)

Financial Management Concentration
The Concentration in Financial Management is designed for students interested in pursuing careers in corporate finance or financial planning. This concentration can be completed in one full year of study if the student chooses the thesis option.

Students in this concentration must complete the core curriculum and the thesis or research project for the M.S. in Economics. In addition, they must complete:

FINN 6152 - Financial Management (3)
FINN 6153 - Investment Management (3)
FINN 6157 - Advanced Corporate Finance (3)

And one of the following:
FINN 6155 - Multinational Financial Management (3)
ECON 6235 - Monetary and Financial Theory (3)
An approved elective course

Applied Economic Analysis Concentration
The Concentration in Applied Economic Analysis is designed for students who wish to pursue a specialized course of study. This concentration can be completed in one full year of study if the student chooses the thesis option.

Students in this concentration must complete the core curriculum and the thesis or research project for the M.S. in Economics. In addition, they must complete 12 credit hours of elective courses chosen from among 5000 level and higher ECON courses, 6000 level and higher FINN courses, or courses approved by the program director.

Thesis or Research Project

Thesis Option
Students who choose the thesis track must successfully complete six credit hours of ECON 6999. The thesis must be written and defended within six calendar years after admission into the M.S. in Economics program. The Thesis Committee, which must be approved by the Graduate Program Director, will consist of a Chair and at least two other faculty members. ECON 6999 is graded on an A, B, C, or U basis.

ECON 6999 Graduate Thesis Research (3)

Research Project/Non-Thesis Option
Students enrolled in the non-thesis option must complete the following research courses:

ECON 6901 Research Methods for Economists I (3)
ECON 6902 Research Methods for Economists II (3)

Degree Total = 30 Credit Hours

Grade Requirements

No more than two grades of C are permitted in the program and at least 18 credit hours must be completed before admission to candidacy. A minimum GPA of 3.0 is required to graduate.

Advising

Prior to, or concurrent with, the first semester of study, each student will be expected to complete a program of study listing each class the student expects to take as a

part of the program. The program of study requires the approval of the coordinator.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Program Certifications/Accreditations
The Belk College of Business is accredited by the Association to Advance Collegiate Schools of Business (AACSB).

Graduate Certificate in Applied Econometrics

The Graduate Certificate in Applied Econometrics provides students with a strong foundation in applied econometrics, a skill set that is increasingly in demand. Additionally, students considering graduate study in economics have the opportunity to explore material prior to formally committing to a full graduate degree program.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Economics:

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- GPA of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college course work attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Certificate Requirements
The Graduate Certificate in Applied Econometrics requires completion of 12 credit hours of 6000-level courses in econometrics. Transfer credits are not accepted into the Graduate Certificate in Applied Econometrics program.

Core Courses (9 credit hours)
ECON 6112 - Graduate Econometrics (3)
ECON 6217 - Advanced Microeconometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)

Elective Course (3 credit hours)
Select one of the following:
ECON 6219 - Financial Econometrics (3)
ECON 6257 - Applied Computational Economics (3)

Certificate Total = 12 Credit Hours

Grade Requirements
Students must earn a grade of B or above in all four courses that make up the certificate program.

GLOBAL BUSINESS

- Master of Business Administration (MBA) with Concentration in Global Business *(See the Business Administration section)*
- MBA in Global Business and Strategy Dual Degree, Graduate Certificate in Global Business and Strategy (Mexico)
- M.S. in Economics/M.Sc. in Economics and Business Administration Dual Degree (Denmark)
- M.S. in Mathematical Finance/Laurea Magistrale (LM) in Banking and Finance Dual Degree (Italy)
- M.S. in Mathematical Finance/ Master's in International Business Dual Degree (China)

Global Business Programs
globalbusiness.charlotte.edu

Dual MBA with specialization in Global Business and Strategy, Graduate Certificate in Global Business and Strategy

The Belk College of Business at UNC Charlotte, in partnership with the Graduate School of Business Administration and Leadership (EGADE) at Tecnológico de Monterrey in Monterrey, Mexico, offers a dual degree Master's program. Students earn two MBA degrees: one from UNC Charlotte and one from Tecnológico de Monterrey. Students also receive a Graduate Certificate in Global Business and Strategy jointly issued from EGADE and the Belk College of Business. The program is taught in English in Monterrey, Mexico. Students in the program have the option of taking one semester at the Belk College of Business in Charlotte, NC. Visit globalbusiness.uncc.edu for additional information.

Admission Requirements
See globalbusiness.charlotte.edu for details.

Degree Requirements
To complete the UNC Charlotte MBA degree, students must complete a total of 36 credit hours (24 credit hours must be taken from the Belk College of Business faculty). The required 36 credit hours does not include preparatory classes.

Required Courses
MBAD 6101 - Ethical Leadership (3)
MBAD 6112 - The Economics of Business Decisions (3)
MBAD 6131 - Financial and Managerial Accounting for MBAs (3)
MBAD 6141 - Operations Management (3)
MBAD 6152 - Financial Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6194 - Global Strategic Management (3)
MBAD 6270 - Marketing Management (3)

Elective Courses
The advisors at EGADE help students select the elective courses that satisfy the dual degree requirements.

Degree Total = 36 Credit Hours

M.S. in Economics/M.Sc. in Economics and Business Administration Dual Degree

The Belk College of Business, in partnership with Copenhagen Business School (CBS), offers a dual degree program in which a student may earn the Belk College M.S. in Economics with Concentration in Financial Management and a M.Sc. in Economics and Business Administration with Concentration in Applied Economics and Finance from CBS. Visit globalbusiness.uncc.edu for additional information.

Admission Requirements
See globalbusiness.charlotte.edu for details.

Degree Requirements
This is a 48 credit hour program in which students earn 24 credit hours at UNC Charlotte and spend one year at CBS to earn the additional 24 credit hours. The dual degree program requires a thesis to be written while at CBS which also satisfies the research portion of the UNC Charlotte degree. All courses are taught in English.

UNC Charlotte Courses
Students spend their first academic year at UNC Charlotte and take the following:

ECON 5172 - Economics of International Finance (3)
ECON 6112 - Graduate Econometrics (3)

ECON 6201 - Advanced Macroeconomic Theory (3)
ECON 6202 - Advanced Microeconomic Theory (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)
FINN 6152 - Financial Management (3)
or MBAD 6152 - Financial Management (3)
FINN 6157 - Advanced Corporate Finance (3)
or MBAD 6157 - Advanced Corporate Finance (3)
FINN 6203 - Financial Economic Theory (3)
or ECON 6203 - Financial Economic Theory (3)

CBS Courses

In the second year at CBS, students take the following courses:

- Inter-Firm Relations: Industrial Organization
- The Firm in a Global Environment
- Firm Theory and Corporate Governance
- Business Project
- Master's Thesis

Degree Total = 48 Credit Hours

M.S. in Mathematical Finance/ Laurea Magistrale (LM) in Banking and Finance Dual Degree

The Belk College of Business, in partnership with Università Cattolica del Sacro Cuore (UCSC) in Milan, Italy, offers a dual degree program. Students in this program may earn the M.S. in Mathematical Finance with a Concentration in Risk Management from UNC Charlotte and a Laurea Magistrale (LM) in Banking and Finance from UCSC. Visit globalbusiness.uncc.edu for additional information.

Admission Requirements

See globalbusiness.charlotte.edu for details.

Degree Requirements

This is a 48 credit hour program in which students earn 24 credit hours at UNC Charlotte and spend one year at UCSC to earn the additional 24 credit hours. In addition to these courses, students are also required to pass the comprehensive exam through UNC Charlotte as well as complete a thesis through UCSC.

UNC Charlotte Courses

Students spend their first academic year at UNC Charlotte and take the following:

FINN 6203 - Financial Economic Theory (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
FINN 6214 - Asset and Portfolio Management (3)
FINN 6215 - Risk Management in Insurance Companies (3)
FINN 6216 - Quantitative Risk Management (3)
FINN 6219 - Financial Econometrics (3)
or ECON 6219 - Financial Econometrics (3)
ECON 6113 - Cross-Section and Time-Series Econometrics (3)
or STAT 6113 - Cross-Section and Time-Series Econometrics (3)
MATH 6203 - Stochastic Calculus for Finance I (3)

UCSC Courses

In the second year at UCSC, students take the following courses:

- Advanced Financial Accounting
- Quantitative Methods for Finance
- Corporate Finance
- Monetary Economics
- Principles of Financial Regulation
- Derivatives Securities Pricing
- Risk Management
- Foreign Language*
- Theology**

** Part of the requirement for the degree is to take a practical Italian language course to learn essential day-to-day words and phrases.*
*** Part of Italian learning is to take a theology course. This is an appreciation/culture course.*

Additional Requirements

In addition to these courses, students are also required to pass the comprehensive exam through UNC Charlotte as well as complete a thesis through UCSC.

Degree Total = 48 Credit Hours

M.S. in Mathematical Finance/ Master's in International Business Dual Degree

The Belk College of Business, in partnership with the Shanghai University of Finance and Economics (SUFE), China, offers a dual degree program. Students in this program earn the M.S. in Mathematical Finance from UNC Charlotte and a Master's in International Business from SUFE. Students study for one year at UNC Charlotte and two years at SUFE.

Students gain strong quantitative skills in mathematics and in-depth knowledge of financial instruments and markets, and gain a solid understanding of finance, monetary economics, and banking regulation. Visit

globalbusiness.uncc.edu for additional information.

Admission Requirements
See globalbusiness.charlotte.edu for details.

Degree Requirements
UNC Charlotte Courses
Students and take the following at UNC Charlotte:

ECON 6113 - Cross-Section and Time-Series Econometrics (3)
FINN 6203 - Financial Economic Theory (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
FINN 6212 - Advanced Financial Derivatives (3)
MATH 6203 - Stochastic Calculus for Finance I (3)
MATH 6204 - Numerical Methods for Financial Derivatives (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)

SUFE Courses
Two of the following courses offered by the program at SUFE can be used to replace corresponding courses offered by the program at UNC Charlotte:

- Analysis of Financial Derivative Instruments
- Stochastic Process
- Fixed Income Securities
- Financial Econometrics

Credit for the above-mentioned courses can be transferred to UNC Charlotte.

Additional Requirements
In addition to these courses, students are also required to pass the comprehensive exam through UNC Charlotte.

MANAGEMENT

- M.S. in Management

Department of Management
belkcollege.charlotte.edu/departments/management

Graduate Program
management.charlotte.edu

M.S. in Management

The Master of Science in Management is a full-time, one-year, 30 credit hour program. The fifth-year M.S. in Management program is designed for recent graduates without a business background who are interested in gaining marketable skills in functional areas of business. The curriculum provides students with a comprehensive overview of key business topics, making graduates marketable in today's business world. Students learn the fundamentals of business in areas such as finance, business analytics, marketing, operations, accounting, economics, information technology, ethics, organizational behavior, and leadership.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in the M.S. in Management program:

- An earned bachelor's degree from a college or university that is accredited by U.S. Department of Education-recognized institutional accreditors in a non-business field
- One letter of recommendation
- A professional résumé

Students are admitted to the program by the Dean of the Graduate School based on the recommendation of the Belk College of Business M.S. in Management Program Director, in consultation with the Belk College of Business M.S. in Management Program Committee. Recommendations are based on the assessments of the Program Director and Program Committee of the candidate's ability to complete the program, as supported by the application materials. If there are more candidates than can be accommodated, candidates are recommended in order of their perceived ability, promise of success, and suitability to the program.

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Prerequisite Course Requirement

Students are required to complete a college algebra course earning a grade of B or above prior to enrolling in the program.

Degree Requirements

The M.S. in Management degree program is comprised of 30 credit hours of coursework. The M.S. in Management is a one year, lockstep program consisting of ten 3-credit hour courses. Up to 6 credit hours of coursework may be transferred from an AACSB-accredited institution of equivalent, based on the recommendation of the relevant academic department, approval of the Director of the M.S. in Management Program, and approval of the Graduate School. All students in the program must meet the Graduate School's requirements for a master's degree.

Required Courses

MSMG 6100 - Quantitative Business Analysis (3)
MSMG 6110 - Principles of Financial and Managerial Accounting (3)
MSMG 6120 - Management and Organizational Behavior (3)
MSMG 6130 - Economics for Managers (3)
MSMG 6140 - Information Systems Management (3)
MSMG 6150 - Managing Talent for Strategic Advantage (3)
MSMG 6160 - Marketing from a Management Perspective (3)
MSMG 6170 - Analysis for Financial Management (3)
MSMG 6180 - Managing Your Organization's Operations (3)
MSMG 6190 - Managerial Ethics and Leadership (3)

Seminar Course

This seminar course is offered in the Summer II, Fall, and Spring semesters. Students are required to register for it in all three semesters. It is graded on a Pass/Unsatisfactory basis.

MSMG 6690 - Career/Professional Development Seminar (0)

Degree Total = 30 Credit Hours

Grade Requirements

Students are expected to earn an A or B in all courses included in the program and must maintain a minimum cumulative 3.0 GPA (on a 4.0 scale) to graduate. An accumulation of three marginal C grades in any graduate coursework will result in suspension of the student's enrollment. If a student earns a U in any course, their enrollment will be suspended and the student cannot take further coursework without being readmitted to the program. Readmission to the program requires approval of the Dean of the Graduate School upon the recommendation of the Program Director.

Admission to Candidacy

Students should consult the Degree Requirements and Academic Policies section of the *Graduate Catalog* for deadlines and processes related to admission to candidacy.

Application for Degree

Students should consult Degree Requirements and Academic Policies section of the *Graduate Catalog* for deadlines and processes related to application for degree.

Advising

Academic Advising is provided by both the Director of the M.S. in Management program and Belk College Graduate Programs staff.

Transfer Credit

Up to 6 credit hours of appropriate graduate credit may be accepted for transfer from another AACSB-accredited (or equivalent) Master's program. Only courses where grades of B or above have been earned will be considered. Approval from the Director of the M.S. in Management program and the Graduate School is also required. All other Graduate School policies regarding transfer credit apply.

Program Certifications/Accreditation

The Belk College of Business is accredited by the Association to Advance Collegiate Schools of Business (AACSB International).

MATHEMATICAL FINANCE

- M.S. in Mathematical Finance
  - Computational Finance
  - Risk Management
  - Financial Data Analytics
- M.S. in Mathematical Finance/Master of Business Administration (MBA) Dual Degree
- M.S. in Mathematical Finance/M.S. in Economics Dual Degree
- M.S. in Mathematical Finance/Laurea Magistrale (LM) in Banking and Finance Dual Degree (Italy) *(see the Global Business section)*
- M.S. in Mathematical Finance/ Master's in International Business Dual Degree (China) *(see the Global Business section)*

Graduate Program

mathfinance.charlotte.edu

M.S. in Mathematical Finance

The Master of Science in Mathematical Finance program is designed to prepare students to pursue careers in quantitative finance. Increasingly firms of all types, but especially financial institutions, investment banks, and commodities firms, rely upon highly sophisticated mathematical models to identify, measure, and manage risk. The advent of these models triggered the emergence of a new discipline, Mathematical Finance. This discipline, sometimes also referred to as "financial engineering," "computational finance," or "quantitative finance," requires professionals with extensive skills in both finance and mathematics.

The Mathematical Finance program at UNC Charlotte is a joint program of the Departments of Finance and Economics in the Belk College of Business and the Department of Mathematics and Statistics in the College of Liberal Arts & Sciences. Students take courses from all three departments in an integrated curriculum. Students may use electives to tailor the program to their specific interests.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for admission to the Master of Science in Mathematical Finance program.

1) A baccalaureate degree in a related field with a minimum GPA of 3.0 on a 4.0 scale.
2) Acceptable scores on each portion of the GRE or GMAT.
3) For applicants from non-English speaking countries, a language requirement score of 557 on the TOEFL or 78% on the MELAB. Non-native speakers of English, may, at the discretion of either the Graduate School or the Program Committee for the MS in Mathematical Finance, be required to enroll in English as a Second Language (ESL) courses at the English Language Training Institute.
4) Specific coursework equivalent to the following: introductory course in the Theory of Finance; a standard two-semester sequence in Calculus; Linear algebra; and at least one upper-level course in Probability and Statistics. Students are strongly recommended to be familiar with at least one programming language, most preferably C or C++. Students lacking this coursework may be admitted subject to the condition that they satisfactorily complete such coursework during the first two semesters that they are enrolled in the program and prior to their taking any program courses where prerequisites are missing.

GMAT/GRE Waiver

The GMAT/GRE application requirement may be waived for applicants meeting the following criteria:

- Early Entry Applicants – undergraduate GPA of 3.2 or above, with grades of A or B in Economics, Math, Stats, and/or Finance courses
- General Applicants – a minimum of three years of domestic work experience in finance, quantitative analysis, computer science or other highly quantitative/analytical field with an undergraduate GPA of 3.0. OR five or more years of international work experience in finance, quantitative analysis, computer science, or other highly quantitative/analytical field with a minimum 3.0 UGPA
- Graduate Certificate in Applied Econometrics Certificate or M.S. in Economics students who have completed a minimum of two courses earning grades of B or above, and have a graduate GPA of 3.0 or above.

The waiver must be requested from the M.S. in Mathematical Finance Graduate Program Director when submitting the completed application. All GMAT/GRE waivers are at the discretion of the Graduate Program

Director. If candidates are unable to secure the GMAT/GRE waiver, they are required to submit official GMAT/GRE test scores in their M.S. in Mathematical Finance program application.

Prerequisite Requirements

Students may enter this program from a variety of undergraduate backgrounds, including finance, mathematics, economics, computer science, actuarial science, statistics, information systems and engineering. As a result, many students admitted will not have the required background to immediately begin taking advanced courses from each of three areas of study. In such cases, the student may be required to take prerequisite courses prior to enrolling in advanced courses in specific fields. These prerequisites would be in addition to the advanced 30 credit hours required for the degree. In general students must have the following background in each field before taking advanced courses in that field:

1) Finance: Have earned an acceptable grade in an introductory course in finance from an AACSB-accredited business school at either the undergraduate or MBA level.
2) Economics: Have earned an acceptable grade in microeconomics at either the undergraduate or MBA level.
3) Mathematics: Have earned acceptable grades in the equivalent of a two course sequence in calculus (differential and integral calculus), a course in linear algebra, and an upper-level course in probability and statistics.

Students are strongly recommended to be familiar with at least one programming language, most preferably C or C++. Again, students may be admitted to the program without meeting all of these requirements. The Program Director, in conjunction with the Departmental Graduate Coordinators, will evaluate each incoming student's academic background to determine in which prerequisite courses the student will be required to enroll. A student who meets the prerequisites in a field may begin taking advanced courses in that field while still taking prerequisite courses in another field. A student must, however, be making satisfactory progress toward fulfilling his or her prerequisites in all fields to remain enrolled in the program.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements

A minimum of 30 credit hours of coursework beyond the bachelor's degree is required to earn the M.S. in Mathematical Finance degree. Students must complete the required six Program Core courses and four Concentration courses corresponding with the selected concentration.

Core Courses (18 credit hours)

ECON 6203 - Financial Economic Theory (3)
or FINN 6203 - Financial Economic Theory (3)
ECON 6113 - Cross-Section and Time Series Econometrics (3)
or STAT 6113 - Cross-Section and Time Series Econometrics (3)
FINN 6219 - Financial Econometrics (3)
or ECON 6219 - Financial Econometrics (3)
FINN 6210 - Financial Elements of Derivatives (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
MATH 6203 - Stochastic Calculus for Finance (3)

Concentrations (12 credit hours)

The degree program offers three concentrations leading to a M.S. in Mathematical Finance. Students who plan to pursue careers in quantitative modeling and pricing analysis are encouraged to elect the Computational Finance Concentration. Students planning to pursue a career in risk management and insurance are encouraged to pursue the program with the Risk Management Concentration. Students interested in a career in financial data analysis and applications are encouraged to elect the Financial Data Analytics concentration.

Concentration in Computational Finance

In addition to the six Program Core courses, the following four courses are required for a M.S. in Mathematical Finance with a Concentration in Computational Finance.

MATH 6204 - Numerical Methods for Financial Derivatives (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)
FINN 6212 - Advanced Financial Derivatives (3)

Concentration in Risk Management

In addition to the six Program Core courses, the following

four courses are required for a M.S. in Mathematical Finance with a Concentration in Risk Management.

FINN 6213 - Risk Management and Financial Institutions (3)
FINN 6214 - Asset and Portfolio Management (3)
FINN 6215 - Risk Management in Insurance Companies (3)
FINN 6216 - Quantitative Risk Management (3)"

Concentration in Financial Data Analytics
In addition to the six Program Core courses, the following four courses are required for a M.S. in Mathematical Finance with a Concentration in Financial Data Analytics.

ECON 6217 - Advanced Microeconometrics (3)
ITCS 6114 - Algorithm and Data Structures (3)
ITCS 6160 - Database Systems (3)
or ITIS 6120 Applied Databases
MBAD 6201 - Business Intelligence and Analytics (3)

Degree Total = 30 Credit Hours

Advising
Advising is done by the Program Director, in conjunction with the Area Coordinators of each of the participating Departments.

Assistantships
A number of assistantships are available each year. In order to be competitive, applications should be submitted by March 15. Additional information is available from the Program Director.

Comprehensive Examination
Student will be required to pass a comprehensive examination. An examining committee will be appointed by the program director and will be constituted from the program's faculty. The exam may be, at the committee's discretion, either written or oral.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Transfer Credit
No more than 6 credit hours and only courses with a grade of A or B at an accredited institution. Requires the recommendation of the Program Director and approval of the Graduate School.

M.S. in Mathematical Finance/ Master of Business Administration (MBA) Dual Degree

This dual degree program allows students to earn both a Master of Science in Mathematical Finance (MAFI) degree and a Master of Business Administration (MBA) degree from the Belk College of Business.

Admission Requirements
Applicants might be offered admission into only the MBA or the MAFI instead of the dual degree program. Similarly, students admitted to the dual program may opt to matriculate into only the MBA or MAFI program. Students who have matriculated into either the MBA or MAFI program who desire to add the dual degree must apply and gain admission to the dual degree no later than the end of their second semester of matriculation into either program. Students must be admitted by both programs, independently.

Degree Requirements
Required Courses (51 credit hours)
The combined program requires students to complete the following courses:
MBAD 6101 - Ethical Leadership (3)
MBAD 6112 - The Economics of Business Decisions (3)
MBAD 6131 - Financial and Managerial Accounting for MBAs (3)
MBAD 6141 - Operations Management (3)
MBAD 6152 - Financial Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6270 - Marketing Management (3)
ECON 6113 - Cross-Section and Time-Series Econometrics (3)
FINN 6203 - Financial Economic Theory (3)
FINN 6210 - Financial Elements of Derivatives (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
FINN 6219 - Financial Econometrics (3)
MATH 6203 - Stochastic Calculus for Finance I (3)
M.S. in Mathematical Finance Elective Course or Master of Business Administration Elective Course (3)
M.S. in Mathematical Finance Elective Course or Master of Business Administration Elective Course (3)
M.S. in Mathematical Finance Elective Course or Master of Business Administration Elective Course (3)
M.S. in Mathematical Finance Elective Course or Master of Business Administration Elective Course (3)

Capstone Experiences (3 credit hours)
The following Capstone Experiences are required:

Master of Business Administration: Students are required to take MBAD 6194 - Global Strategic Management (3)

M.S. in Mathematical Finance: Students are required to pass a comprehensive examination. An examining committee is appointed by the Graduate Program Director and is constituted from the program's faculty. The exam may be, at the committee's discretion, either written or oral.

Dual Degree Total = 54 Credit Hours

Grade Requirements
Graduate students must have a 3.0 GPA in the courses on their degree plan of study in order to graduate.

M.S. in Mathematical Finance/ M.S. in Economics Dual Degree

This dual degree program allows students to earn both a Master of Science in Mathematical Finance (MAFI) degree and a Master of Science in Economics (MSE) from the Belk College of Business.

Admission Requirements
Applicants might be offered admission into only the MSE or the MAFI instead of the dual degree program. Similarly, students admitted to the dual program may opt to matriculate into only the MSE or MAFI program. Students who have matriculated into either the MSE or MAFI program who desire to add the dual degree must apply and gain admission to the dual degree no later than the end of their second semester of matriculation into either program. Students must be independently admitted to both programs.

Degree Requirements
Required Courses (39 credit hours)
The combined program requires students to complete the following courses:
ECON 6112 - Graduate Econometrics (3)
or ECON 6113 - Cross-Section and Time-Series Econometrics (3)
ECON 6201 - Advanced Macroeconomic Theory (3)
ECON 6202 - Advanced Microeconomic Theory (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)
FINN 6203 - Financial Economic Theory (3)
FINN 6210 - Financial Elements of Derivatives (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
FINN 6219 - Financial Econometrics (3)
MATH 6203 - Stochastic Calculus for Finance I (3)
M.S. in Mathematical Finance Elective Course or M.S. in Economics Elective Course (3)
M.S. in Mathematical Finance Elective Course or M.S. in Economics Elective Course (3)
M.S. in Mathematical Finance Elective Course or M.S. in Economics Elective Course (3)
M.S. in Mathematical Finance Elective Course or M.S. in Economics Elective Course (3)

Capstone Experiences (6 credit hours)
The following Capstone Experiences are required:

M.S. in Economics: Thesis option OR Research Project option.

Students who choose the thesis option must successfully complete six credit hours of ECON 6999 - Graduate Thesis Research. The thesis must be written and defended within six calendar years after admission into the M.S. in Economics program. The Thesis Committee, which must be approved by the Graduate Program Director, will consist of a Chair and at least two other faculty members.

Students who choose the research project option must complete the following research courses:

ECON 6901 - Research Methods for Economists I (3)
ECON 6902 - Research Methods for Economists II (3)

M.S. in Mathematical Finance: Comprehensive Examination.

Students are required to pass a comprehensive examination. An examining committee is appointed by the Graduate Program Director and is constituted from the program's faculty. The exam may be, at the committee's discretion, either written or oral.

Dual Degree Total = 45 Credit Hours

Grade Requirements
Graduate students must have a 3.0 GPA in the courses on their degree plan of study in order to graduate.

REAL ESTATE AND DEVELOPMENT

- M.S. in Real Estate (MSRE)
- M.S. in Real Estate/MBA Dual Degree
- MBA with Concentration in Real Estate Finance and Development *(see Business Administration section)*
- MBA Plus with Concentration in Real Estate Finance and Development *(see Business Administration section)*
- M.S. in Economics with Concentration in Urban Economics and Real Estate *(see Economics section)*
- Graduate Certificate in Real Estate and Development

Graduate Program
realestate.charlotte.edu

M.S. in Real Estate

The Master of Science degree in Real Estate (MSRE) is designed to provide students with the skills necessary to analyze, evaluate and execute complex real estate investment and development transactions. The curriculum draws from academic disciplines such as architecture, engineering, finance, and geography to emphasize the multidisciplinary nature of the real estate industry and the diverse skill set required for success. Students graduating from the program will have the skills necessary to qualify for positions such as development associates, underwriters, brokers, asset and property managers, acquisition specialists, and financial analysts.

MSRE courses are scheduled to accommodate both full-time and part-time students. The program is structured to allow full-time students to complete the curriculum within one calendar year. Full-time students may enroll in up to thirteen (13) credit hours each semester and are expected to complete a capstone course and international study tour in the summer following the first academic year in the program. Part-time students may enroll in four (4) to seven (7) credit hours each semester and are expected to complete the capstone course and international study tour in the summer following the completion of all other program requirements. All courses required to complete the curriculum are offered in the evening at UNC Charlotte's Center City Campus.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Real Estate:

1) A general satisfactory undergraduate record from a college or university accredited by an accepted accrediting body and an undergraduate GPA of at least 3.0
2) A satisfactory score on the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE)
3) A satisfactory score on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) for applicants from non-English speaking countries
4) A full resume or a description of significant work experience

GMAT/GRE Waiver
To be eligible for a GMAT/GRE waiver, candidates must fully satisfy the requirements of one of the following options:

Option A
- Minimum 3.5 cumulative GPA (graduate or undergraduate) from an accredited institution
- Only candidates with significant quantitative coursework will be considered

Option B
- Minimum 3.0 cumulative GPA (graduate or undergraduate) from an accredited institution
- Candidates must possess 5 years of professional in a relative field or military experience that demonstrates applied and analytical skills (significant leadership experience is a plus)

Degree Requirements
The MSRE degree requires the completion of a 32 graduate credit hours. Necessary preparatory work will be determined during the admissions process and courses to meet the specific need will be available in the MSRE program's prerequisite course requirements. All students in the program must meet the Graduate School's requirements for a Master's Degree.

Prerequisite Courses (6 credit hours)
Prerequisite courses may be taken after admission to the MSRE program. The courses must, however, be completed before enrolling in 6000-level courses except by permission of the MSRE Graduate Program Director.

MSRE 5110 - Foundations in Economics (3)
MSRE 5131 - Fundamentals of Financial Accounting & Financial Management (3)

Required Core Courses (24.5 credit hours)
MSRE 6101 - Real Estate Seminar (1) *(must be taken twice for credit)**
MSRE 6102 - International Real Estate Study Tour (3) **
MSRE 6120 - Real Estate Law (1.5)
MSRE 6152 - Financial Management (3)
MSRE 6158 - Real Estate Finance and Investment (3)
MSRE 6159 - Real Estate Development (3)
MSRE 6160 - Real Estate Capital Markets (3)
MSRE 6238 - Real Estate and Urban Economics (3) ***
MSRE 6999 - Real Estate Capstone (3)

**MSRE 6101 is a one credit hour course that students must take twice for credit before graduation. Students enrolled in the course will be required to participate in real estate trade organization meetings, engage in leadership and negotiation training, attend guest lecturers covering emerging trends in real estate and ethical business practices, and complete professional development seminars.*

***MSRE 6102 is a study abroad experience that requires students to travel to an international real estate market and examine local real estate development practices over the course of one week.*

****MSRE 6230 is not part of the required courses in the curriculum but, when offered, may substitute for another course at the discretion of the Director of the M.S. in Real Estate Program.*

****Students may also elect to take MSRE 6258 in lieu of MSRE 6238. All other courses included in the functional component of the curriculum must be completed by MSRE students unless otherwise stated.*

Elective Courses (7.5 credit hours)
Select from the following:
MSRE 6130 - Site Planning (1.5)
MSRE 6210 - Student Managed Real Estate Investment Fund (3)
MSRE 6220 - Financial Analysis of Real Estate Investments (1.5)
MSRE 6230 - Construction Management (1.5)
MSRE 6240 - Real Estate Valuation Methods (3)
MSRE 6241 - Advanced Topics in Real Estate (3)
MSRE 6242 - Asset Management (3)
MSRE 6245 - Real Estate Market Analysis (1 to 3)
MSRE 6258 - Site Feasibility Analysis (3)
MSRE 6310 - Land Use Policy (1.5)

Degree Total = 32 Credit Hours

Assistantships
A limited number of assistantships are available each year. In order to be competitive, applications should be submitted by March 15. Additional information is available in the office of the Center for Real Estate and on the Graduate School website.

Advising
Advising is provided by the Graduate Program Director of the MSRE program.

Transfer Credit
Up to six hours of appropriate graduate credit may be accepted for transfer from another AACSB-accredited (or equivalent) graduate program. Only courses where grades of B or above have been earned will be considered. Approval of the Program Director and the Graduate School is also required. All other Graduate School policies regarding transfer credit apply.

Program Certifications/Accreditation
The MSRE Program and all degree and certificate programs offered by the Belk College of Business are accredited by the Association to Advance Collegiate Schools of Business (AACSB-International).

M.S. in Real Estate/Master of Business Administration (MBA) Dual Degree

This dual degree program allows students to earn both a Master of Science in Real Estate (MSRE) and Master of Business Administration (MBA) degree from the Belk College of Business. A dual degree equips students with both general business skills and specific knowledge and expertise in real estate, which better prepares students for a successful career in the future.

Admission Requirements
Applicants might be offered admission into only the individual M.S. in Real Estate (MSRE) or Master of Business Administration (MBA) program instead of the dual degree program. Similarly, students admitted into the dual degree program may opt to matriculate into only the MSRE or MBA program. Students who have matriculated into either the MSRE or MBA program who desire to add the dual degree must apply and gain admission to the dual degree no later than the end of their first semester of matriculation into either program.

Degree Requirements
The dual degree program requires 53 credit hours of coursework.

Required Courses (47 credit hours)
MBAD 6101 - Ethical Leadership (3)
MBAD 6112 - The Economics of Business Decisions (3)

MBAD 6131 - Financial and Managerial Accounting for MBAs (3)
MBAD 6141 - Operations Management (3)
or MBAD 6209 - Management of Service Operations (3)
MBAD 6152 - Financial Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6270 - Marketing Management (3)
MSRE 6101 - Real Estate Seminar (1) *(taken for two semesters)*
MSRE 6102 - International Real Estate Study Tour (3)
MSRE 6120 - Real Estate Law (1.5)
MSRE 6130 - Site Planning (1.5)
MSRE 6158 - Real Estate Finance and Investment (3)
MSRE 6159 - Real Estate Development (3)
MSRE 6160 - Real Estate Capital Markets (3)
MSRE 6220 - Financial Analysis of Real Estate Investments (3)
MSRE 6238 - Real Estate and Urban Economics (3)
or MSRE 6258 - Site Feasibility Analysis (3)

Capstone Courses (6 credit hours)
MBAD 6194 - Global Strategic Management (3)
MSRE 6999 - Real Estate Capstone (3)

Degree Total = 53 Credit Hours

Grade Requirements
Students must have a cumulative 3.0 GPA to graduate from the dual degree program.

Graduate Certificate in Real Estate and Development

The Graduate Certificate in Real Estate and Development requires completion of 15 credit hours (one core and four elective courses) of 6000-level courses in real estate finance and development. Transfer credits are not accepted into the Graduate Certificate in Real Estate Finance and Development program. Students must earn a grade of B or above in all five courses that make up the certificate program.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Real Estate and Development:

1) A generally satisfactory undergraduate record from an accredited college or university
2) Basic proficiency in using spreadsheet computer software
3) Completion of MBAD 5131 (Fundamentals of Financial Accounting and Financial Management) or its equivalent
4) A minimum of six years of business experience is strongly preferred

Note: MBA students concentrating in real estate finance and development are ineligible to enroll in the Graduate Certificate in Real Estate and Development program.

Applications are reviewed on a continuous basis. Participants may enroll for the first time in Fall, Spring, or Summer terms.

Certificate Requirements
This 15-credit certificate program consists of:

Core Requirement (3 credit hours)
MSRE 6152 - Financial Management (3)

Elective Courses (12 credit hours)
Select four of the following:
MSRE 6158 - Real Estate Finance and Investment (3)
MSRE 6159 - Real Estate Development (3)
MSRE 6160 - Real Estate Capital Markets (3)
MSRE 6258 - Site Feasibility Analysis (3)
MSRE 6259 - Applied Real Estate Development (3)
ECON 6250 - Advanced Urban and Regional Economics (3)

Certificate Total = 15 Credit Hours

College of Computing and Informatics

cci.charlotte.edu

The College of Computing and Informatics at the University of North Carolina at Charlotte aspires to be a national leader in advancing the role of computing and informatics as a catalyst for the 21st Century economy. As the only school of its kind in the Carolinas, students are prepared to shape the future of computing by participating in educational and research programs that respond directly to the needs of business and government. Its research and educational programs offer students a combination of strong technical knowledge with broad domain understanding and workforce skills. The world has become a computing and informatics-based society. All industries require computing and informatics talent. The demand for computing and informatics talent and innovation will continue to grow. The UNC Charlotte College of Computing and Informatics advances the field with its combination of the latest science, industry expertise, and dedicated faculty and students. The College is designated as a National Center of Academic Excellence in Information Assurance Education by the National Security Agency and the U.S. Department of Homeland Security. Hard at work on a full spectrum of research topics, the College of Computing and Informatics has broken new ground in bioinformatics, computer security, data and visual analytics, data science, health informatics, human-centered computing, information technology, robotics, and visualization applications.

- The primary mission of CCI includes:
- Cultivating an inclusive culture dedicated to student success and equity in education
- Stimulating innovative high-risk high-impact research and development
- Maintaining a resilient and ethical society of educated, caring citizens

Areas of interest to College of Computing and Informatics researchers include: Access Control, Authentication and Identification, Bioinformatics, Communication Networks, Complex Adaptive Systems, Computational Biophysics, Computational Mass Spectrometry, Computer Architecture, Computer Graphics, Computer Vision, Cryptography and Applications, Data Mining, Enterprise Security, Enterprising Integration, Evolutionary Computation, Genome Annotation, Genome Wide Association Analysis, Human Computer Interaction, Image/Video Processing, Information Security and Assurance, Insider Threat Prevention and Detection, Intelligent Systems, Intrusion Prevention and Detection, Knowledge Based Systems, Knowledge Discovery, Metagenomics, Modeling and Simulation of Information Infrastructure, Multi-Agent Systems, Multimedia Databases, Network and Distributed Systems Security, Neural Networks, Privacy Preserving Technology, Provably Secure Systems, Robotics, Scientific and Information Visualization, Security Protocols, Soft Computing,

Software Engineering, Software Verification and Validation, Software Testing, Structural Bioinformatics, Survivable Security Systems, Systems Biology, Virtual Reality, Web Security, Wireless Networks, and Wireless Security.

Graduate Degree Programs

- Ph.D. in Bioinformatics and Computational Biology
- Ph.D. in Computing and Information Systems
- M.S. in Bioinformatics
- M.S. in Computer Science
- M.S. in Cybersecurity
- M.S. in Data Science and Business Analytics *(see the "School of Data Science" section of this Catalog)*
- M.S. in Health Informatics and Analytics *(see the "School of Data Science" section of this Catalog)*
- M.S. in Information Technology
- Master of Architecture and M.S. in Information Technology Dual Degree

Graduate Non-Degree Programs

- Graduate Certificate in Applied Artificial Intelligence
- Graduate Certificate in Bioinformatics Applications
- Graduate Certificate in Bioinformatics Technology
- Graduate Certificate in Data Science and Business Analytics *(see the "School of Data Science" section of this Catalog)*
- Graduate Certificate in Game Design and Development
- Graduate Certificate in Health Informatics and Analytics *(see the "School of Data Science" section of this Catalog)*
- Graduate Certificate in Human-Computer Interaction
- Graduate Certificate in Information Security and Privacy
- Graduate Certificate in Information Technology Management
- Graduate Certificate in Network Security
- Graduate Certificate in Secure Software Development
- Graduate Certificate in Software Development

BIOINFORMATICS AND GENOMICS

- Ph.D. in Bioinformatics and Computational Biology
- M.S. in Bioinformatics
- Graduate Certificate in Bioinformatics Applications
- Graduate Certificate in Bioinformatics Technology

Department of Bioinformatics and Genomics

bioinformatics.charlotte.edu

Ph.D. in Bioinformatics and Computational Biology

The Ph.D. in Bioinformatics and Computational Biology (BCB) is granted for planning, execution, and defense of original research resulting in significant contributions to the discipline's body of knowledge. Moreover, the BCB Ph.D. program also requires didactic coursework to prepare the student for research success. Student progress is primarily assessed by: (a) satisfactory coursework performance, (b) the Qualifying Examination, (c) the Dissertation Proposal, and (d) the Dissertation Defense. Courses and the Qualifying Examination are used to ensure that the student has sufficient breadth of knowledge. The Dissertation Proposal is used to ensure that the scope of dissertation research is important, that the plan is well thought out and that the student has sufficient skills and thoughtfulness needed for success. The Dissertation Defense is used to assess the outcomes of the dissertation research, and whether or not the plan agreed upon by the Dissertation Committee has been appropriately followed.

Admissions Requirements

The Ph.D. in Bioinformatics and Computational Biology admits students on a competitive basis. Preference is given to applicants with strong credentials and appropriate undergraduate and/or professional preparation.

- A baccalaureate degree from an institution accredited by an accepted accrediting body. Admission requirements for Bioinformatics track will include an adequate preparation in chemistry, biology, mathematics (preferably statistics), and computer science. Strong candidates may be allowed to make up deficiencies in some area at the discretion of the

Bioinformatics admissions subcommittee.

- Evidence of scholarly and creative activity, including publication list; awards; results in national or international contests related to information technology, and the like
- A minimum GPA of 3.0 (on a 4.0 scale)
- Excellent GRE scores
- Three letters of reference from professionals working in the applicant's field of interest that addresses the applicant's previous experience and potential to do research
- Personal statement. Please include answers to the following questions:

    1) What area(s) of research in Bioinformatics and Genomics are you most interested in? Which faculty members in the department would you most like to work with in order to further pursue these areas? Please discuss at least 3 different faculty, but no more than five.
    2) Why have you chosen to apply to this particular program? What are your career goals, and how will a degree from this program help you achieve those goals?
    3) What kind of prior experience do you have that you feel has prepared you for graduate-level research? If you have done research as an undergraduate, please tell us about the questions you were aiming to answer, your role in the research project, and what the outcome was. If you have not done research as an undergraduate, tell us instead about other projects or work efforts that you led, and what you did to accomplish the project goals.
    4) What kind of technical skills do you have that are most relevant to the Ph.D. program in Bioinformatics and Genomics?
    5) What would you describe as your biggest personal strengths? How do you feel these strengths will increase your chance of success in a Ph.D. program?

GRE Waiver

The GRE can be waived if one of the following conditions are met:

1) Applicant obtained, or will complete prior to enrollment, a M.S. degree from a college or university in the U.S. accredited by an accepted accrediting body, with a GPA of 3.2 or higher, in a STEM major related to Bioinformatics and Genomics
2) Applicant obtained, or will complete prior to enrollment, a B.S. degree from an accredited U.S. institution, with a GPA of 3.4 or higher, in a STEM major related to Bioinformatics and Genomics

Please note: a waiver of the GRE requirement does not constitute an offer of admission into the program.

Degree Requirements

The BCB program requires 72 credit hours in 8000-level BINF courses, or prior approved substitutions. All students must complete two Research Rotations in the first year of the program; each provides a semester of faculty supervised research experience to supplement regular course offerings. Students must complete the Core Courses prior to taking the Qualifying Exam. In consultation with their Academic Advisor and/or Program Director, students frequently also take an appropriate selection of the Gateway Courses in order to be prepared for the Core Courses. For example, an incoming student with a Computer Science background would be expected to take BINF 8100 and BINF 8101, but not BINF 8111. All students must complete the Core Courses prior to taking the Qualifying Examination. Each Ph.D. student must complete two Research Rotations in the first year. Each Research Rotation provides a semester of faculty supervised research experience to supplement regular course offerings. Graduate Research Seminar is taken every semester until the semester following advancement to candidacy. Finally, many additional Elective Courses are available, but are not explicitly required.

Gateway Courses

(as needed, based on student's background)
BINF 8100 - Biological Basis of Bioinformatics (3)
BINF 8101 - Energy and Interaction in Biological Modeling (3)
BINF 8111 - Bioinformatics Programming I (3)

Core Courses

BINF 8112 - Bioinformatics Programming II (3)
BINF 8200 - Statistics for Bioinformatics (3)
BINF 8201 - Molecular Sequence Analysis (3)
BINF 8202 - Computational Structural Biology (3)
or BINF 8203 - Genomics (3)

Research Rotations

BINF 8911 - Research Rotation I (2)
BINF 8912 - Research Rotation II (2)

Graduate Research Seminar

BINF 8600 - Bioinformatics Seminar (1) *(Must be taken every semester until the semester following advancement to candidacy)*

Research Hours

BINF 8991 - Doctoral Dissertation Research (1 to 9) *(Must take a minimum of 18 hours)*

Responsible Conduct of Research

Select one of the following
GRAD 8302 - Responsible Conduct of Research (2)
BINF 8151 - Professional Communications (1)

Elective Courses
Any graduate level BINF prefix course may be taken as a pre-approved elective. Other courses may be taken with department approval.

Degree Total = 72 Credit Hours

Qualifying Examination
Prior to defining a research topic, students are required to pass a Qualifying Examination to demonstrate proficiency in bioinformatics and computational biology, as well as competence in fundamentals common to the field. The Qualifying Examination must be passed prior to the fifth semester of residence. It is composed of both written and oral components that emphasize material covered in the Core Courses listed above.

Dissertation Proposal
Each student must present and defend a Ph.D. Dissertation Research Proposal within two semesters of passing the Qualifying Examination. The Dissertation Proposal defense will be conducted by the student's Dissertation Committee, and will be open to faculty and students. The proposal must address a significant, original and substantive piece of research. The proposal must include sufficient preliminary data and a timeline such that the Dissertation Committee can assess its feasibility.

Dissertation
Each student must complete a well-designed original research contribution, as agreed upon by the student and Dissertation Committee at the Dissertation Proposal. The Ph.D. Dissertation is a written document describing the research and its results, and their context in the sub-discipline. The Dissertation Defense is a public presentation of the findings of the research, with any novel methods that may have been developed to support the conclusions. The student must present the Dissertation and defend its findings publicly, and in a private session with the Dissertation Committee immediately thereafter.

M.S. in Bioinformatics

A unique master's degree merging the biological sciences and computer technology, the M.S. in Bioinformatics is an interdisciplinary program at the intersection of the disciplines of Biology, Chemistry, Mathematics and Statistics, Computing and Informatics, and Engineering. It is expected that students entering the program will have completed an undergraduate major in either a life science or a quantitative discipline. The degree requires additional training and demonstrated competence in both life sciences and scientific programming. The M.S. in Bioinformatics program is structured to provide students with the skills and knowledge to develop, evaluate, and deploy bioinformatics and computational biology applications. The program is designed to prepare students for employment in the biotechnology sector, where the need for knowledgeable life scientists with quantitative and computational skills has exploded in the past decade.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for study toward the M.S. in Bioinformatics:

Under most circumstances, students admitted to the program will have:

- A baccalaureate degree from a college or university accredited by an accepted accrediting body in Biology, Biochemistry, Chemistry, Physics, Mathematics, Statistics, Computer Science, or another related field that provides a sound background in life sciences, computing, or both
- A minimum undergraduate GPA of 3.0 (4.0 scale) and 3.0 in the major (this requirement is waived for Early Entry program applicants who meet the University's overall GPA requirement (3.2 and 75-90 hours of completed undergraduate coursework) in Biology, Chemistry, Physics, Math, SIS or CS, or another UNC Charlotte major if the department determines the student's preparation is appropriate)
- A combined TOEFL score of 557 (paper-based) or 83 (Internet-based) is required if the previous degree was from a country where English is not the common language
- Applicants who earned a degree from an institution outside of the United States must have their transcripts evaluated by one of the current members of the National Association of Credential Evaluation Services (WES is preferred)
- Three positive letters of recommendation

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
The M.S. in Bioinformatics degree requires a minimum of 34 graduate credit hours, and a minimum of 30 credit hours of formal coursework. A minimum of 24 credit

hours presented toward an M.S.in Bioinformatics must be from courses numbered 6000 or higher. A maximum of 6 hours of graduate credit may be transferred from other institutions.

Because of the interdisciplinary nature of this program, which is designed to provide students with a common graduate experience during their professional preparation for the M.S. in Bioinformatics degree, all students are required to take a general curriculum that includes a two-year sequence of courses as described below:

Core Bioinformatics Courses (18 credit hours)
All students must take the following Core Courses. Students who have previously taken a course with a syllabus that closely follows one of the Core Courses may test out of the core requirement by passing a written exam, and may then substitute an advanced elective for the required Core Course.

BINF 6101 - Energy and Interaction in Biological Modeling (3)
BINF 6112 - Bioinformatics Programming II (3)
BINF 6200 - Statistics for Bioinformatics (3)
BINF 6201 - Molecular Sequence Analysis (3)
BINF 6202 - Computational Structural Biology (3)
or BINF 6203 - Genomics (3)
BINF 6211 - Design and Implementation of Bioinformatics Databases (3)

Gateway Courses (3 credit hours)
The department offers two intensive graduate-level courses designed to provide accelerated training in a second discipline that complements the student's undergraduate training. Students entering the program without preparatory coursework in computing or biology may need to take the Gateway course that is appropriate for their background. These courses are not required core courses for all students, but are designed to satisfy core course prerequisites for students who have not encountered the material presented in a previous course. Select one of the following:

BINF 6100 - Biological Basis of Bioinformatics (3) *(for students with computing backgrounds)*
BINF 6111 - Bioinformatics Programming I (3) *(for students with biological science backgrounds)*

Professional Preparation Course (3 credit hours)
Students are required to take at least 3 credit hours of professional preparation courses designed to prepare them to function effectively and ethically in a professional scientific environment. Select one of the following:

BINF 5171 - Business of Biotechnology (3)
BINF 5191 - Life Sciences and the Law (3)

Elective Courses (9 credit hours)
The remaining 9 credit hours of required coursework can be satisfied by elective courses. The M.S. Graduate Coordinator, in conjunction with the Graduate Program Director, reviews the student's plan of study each semester.

Bioinformatics Elective Courses
Any BINF courses, with the exception of Gateway courses, are open to M.S. students seeking to complete their coursework requirements.

Recommended Elective Courses Offered By Other Departments
A wide range of graduate courses in Biology, Chemistry, Computer Science, Data Science, Health Informatics and Analytics, Software and Information Systems, and other programs may be appropriate electives for M.S. in Bioinformatics students. As course offerings change frequently, the Department of Bioinformatics and Genomics maintains a list of current recommended electives.

Bioinformatics Seminar and Research Experience (4 credit hours)
In addition to 30 credit hours of formal coursework, students are required to enroll in the Bioinformatics Program seminar (BINF 6600) for at least one semester (1 credit hour) and to enroll in either Principles of Team Science (BINF 6399), internal or external internship (BINF 6400), or a faculty-supervised original research project (BINF 6900).

BINF 6600 - Bioinformatics Seminar (1)

Plus one of the following:
BINF 6399 - Principles of Team Science (3)
BINF 6400 - Internship Project (1 to 3)
BINF 6900 - Master's Thesis (1 to 3)

Degree Total = 34 Credit Hours

Grade Requirements
An accumulation of three C grades will result in suspension of the student's enrollment in the graduate program. If a student makes a grade of U in any course, enrollment in the program will be suspended.

Transfer Credit
A maximum of 6 credit hours of coursework from other institutions will count toward the M.S. in Bioinformatics degree requirements. Only courses with grades of A or B from an institution accredited by an accepted accrediting body are eligible for transfer credit.

Graduate Certificate in Bioinformatics Applications

The Graduate Certificate in Bioinformatics Applications trains students in the application of established bioinformatics methods for analysis of biological sequence, structure, and genomic data. The certificate requires twelve (12) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte or as a standalone program.

Admission Requirements

For admission into the certificate program, applicants must meet the following requirements:

1) A bachelor's degree in a life science discipline, that includes advanced coursework in molecular biology and genetics.
2) Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Required Courses (6 credit hours)

Students take the following courses that introduce core methods for analysis of molecular biological data:

BINF 6200 - Statistics for Bioinformatics (3)
BINF 6203 - Genomics (3)

Elective Courses (6 credit hours)

Select two of the following:
BINF 6201 - Molecular Sequence Analysis (3)
BINF 6211 - Design and Implementation of Bioinformatics Databases (3)
BINF 6350 - Biotechnology and Genomics Laboratory (3)

Certificate Total = 12 Credit Hours

If a student wishes to enter the program having completed coursework that is equivalent to one or more of the core requirements, the requirements may be waived at the discretion of the certificate coordinator. In this case, the required 12 credit hours may be selected from other advanced graduate courses offered by the Department of Bioinformatics and Genomics.

Transfer credit may not be applied toward this certificate.

It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatics methods.

Graduate Certificate in Bioinformatics Technology

The Graduate Certificate in Bioinformatics Technology trains students in method development for analysis of large-scale biological data and modeling of complex biological systems, with a focus on acquiring complementary skill sets in life sciences and in programming, statistical analysis, and database development. The certificate requires fifteen (15) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

For admission into the certificate program, applicants must meet the following requirements:

1) A bachelor's degree in related field, including, but not limited to, a life science, physical science, mathematics, or computing discipline.
2) Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Students will follow one of two pathways through the program, depending on their bachelor's degree field and previous experience. The following courses make up the required core:

Required Courses (12 credit hours)
If the bachelor's degree is in life sciences:
BINF 6111 - Bioinformatics Programming I (3)
BINF 6112 - Bioinformatics Programming II (3)
BINF 6200 - Statistics for Bioinformatics (3)
BINF 6203 - Genomics (3)

If the bachelor's degree is in computing or mathematics:
BINF 6100 - Biological Basis of Bioinformatics (3)
BINF 6112 - Bioinformatics Programming II (3)
BINF 6200 - Statistics for Bioinformatics (3)
BINF 6203 - Genomics (3)

Elective Courses (3 credit hours)
Select one of the following:
BINF 6201 - Molecular Sequence Analysis (3)
BINF 6211 - Design and Implementation of Bioinformatics Databases (3)

Certificate Total = 15 Credit Hours

If a student wishes to enter the program having completed coursework that is equivalent to the core course requirements, the core requirements may be waived at the discretion of the certificate coordinator. In this case, the required 15 coursework hours may be selected from the electives listed above, or from other advanced graduate courses offered by the Department of Bioinformatics and Genomics.

Transfer credit may not be applied toward this certificate.

It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.

COMPUTER SCIENCE

- M.S. in Computer Science
  - AI, Robotics, and Gaming
  - Data Science
  - Information Security and Privacy
  - Software, Systems, and Networks
- Master of Architecture and M.S. in Information Technology Dual Degree
  (see under Architecture in the "College of Arts + Architecture" section)
- Graduate Certificate in Applied Artificial Intelligence
- Graduate Certificate in Game Design and Development

Department of Computer Science
cs.charlotte.edu

M.S. in Computer Science

The Master of Science in Computer Science program provides students advanced skills and knowledge in planning, design, implementation, testing, and management of computer systems, applications, and infrastructures. These skills form a foundation for employment in high tech industry, or doctoral study in computer science.

The active research areas in the Department of Computer Science include 3D HCI, Algorithms, Artificial Intelligence, Biomedical Imaging, Biometrics, Cloud Computing, Cognitive Science, Communication Networks, Computer Science Education, Computer Vision, Data Mining, Game Design, Graphics, Haptics, Health Informatics, High Performance Computing, Image/Video Processing, Information Visualization, Intelligent Systems, IoT, Knowledge Based Systems, Knowledge Discovery, Machine Learning, Natural Language Processing, Neural Systems, Parallel Computing, Recommender Systems, Robotics, Software Engineering, Virtual Reality, Visual Analytics, and Wireless Networks.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, students applying for this program are expected to have knowledge of programming languages, data structures and algorithms, operating systems, or computer architecture. The knowledge of calculus, discrete mathematics, and linear algebra typically attained in undergraduate education is expected, too. Students without undergraduate prerequisite courses in

computer science and mathematics may be instructed to demonstrate prior knowledge, as determined by the Graduate Program Director.

A bachelor's degree in computer science is desired. Individuals who have worked as professionals in the computer industry may be able to substitute work experience for some of the specific subject area admission requirements, subject to review by the Graduate Program Director.

Students must have an undergraduate grade point average of (or equivalent to) at least 3.0 (on a 4.0 point scale) and a Junior/Senior GPA of at least 3.0. A satisfactory GRE score is required for applicants who completed undergraduate degree outside of the United States.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Master of Science in Computer Science program requires 30 graduate credit hours with a minimum 3.0 GPA, which may optionally include 6 credit hours of thesis. At least 18 credit hours of the courses applied to the degree must be from the Department of Computer Science, and at least 24 hours must be from the College of Computing and Informatics. At least 15 credit hours must be at the 6000-level or above courses. No more than 6 credit hours may be in Individual Study. A maximum of 6 credit hours of graduate credit may be transferred from other graduate degree programs.

Core Courses (12 credit hours)

Select four courses, one from each core group, to satisfy the core requirements.

Foundation of Computing Core

ITCS 6114 - Algorithms and Data Structures (3)
ITCS 6115 - Advanced Algorithms (3)
ITCS 6156 - Machine Learning (3)

AI, Robotics, and Gaming Core

ITCS 5152 - Computer Vision (3)
ITCS 6120 - Computer Graphics (3)
ITCS 6150 - Intelligent Systems (3)

Data Science and Management Core

ITCS 5122 - Visual Analytics (3)
ITCS 6162 - Knowledge Discovery in Databases (3)
ITCS 6345 - Modern Data Science Systems (3)

Software, Systems, and Networks Core

ITCS 5145 - Parallel Computing (3)
ITCS 6166 - Computer Communications and Networks (3)
ITCS 6182 - Computer System Architecture (3)

Optional Concentration (9 credit hours)

Students who choose to declare a concentration must take at least 9 credit hours of courses listed in that concentration (see below). Courses used to fulfill the core requirement cannot be counted for credit in an area of concentration.

AI, Robotics, and Gaming Concentration (ARGC)

Select three of the following:
ITCS 5152 - Computer Vision (3)
ITCS 5153 - Applied Artificial Intelligence (3)
ITCS 5156 - Applied Machine Learning (3)
ITCS 5230 - Introduction to Game Design and Development (3)
ITCS 5231 - Advanced Game Design and Development (3)
ITCS 5232 - Game Design and Development Studio (3)
ITCS 5235 - Game Engine Construction (3)
ITCS 5236 - Artificial Intelligence for Computer Games (3)
ITCS 6050 - Topics in Intelligent Systems (3)
ITCS 6120 - Computer Graphics (3)
ITCS 6125 - Virtual and Augmented Reality (3)
ITCS 6127 - Real-Time Rendering Engines (3)
ITCS 6134 - Digital Image Processing (3)
ITCS 6150 - Intelligent Systems (3)
ITCS 6151 - Intelligent Robotics (3)
ITCS 6152 - Robot Motion Planning (3)
ITCS 6156 - Machine Learning (3)
ITCS 6158 - Natural Language Processing (3)
ITCS 6500 - Complex Adaptive Systems (3)
ITCS 6881 - Individual Study in AI, Robotics, and Gaming (1 to 3)
ITCS 6991 - Computer Science Thesis (1 to 3)

Data Science Concentration (DSC)

Select three of the following:
ITCS 5121 - Information Visualization (3)
ITCS 5122 - Visual Analytics (3)
ITCS 5123 - Visualization and Visual Communication (3)
ITCS 6040 - Topics in Data Science (3)
ITCS 6100 - Big Data Analytics for Competitive Advantage (3)
ITCS 6124 - Illustrative Visualization (3)
ITCS 6126 - Large Scale Information Visualization (3)
ITCS 6140 - Data Visualization (3)
ITCS 6155 - Knowledge-Based Systems (3)
ITCS 6157 - Visual Databases (3)
ITCS 6160 - Database Systems (3)
ITCS 6161 - Advanced Topics in Database Systems (3)
ITCS 6162 - Knowledge Discovery in Databases (3)
ITCS 6163 - Data Warehousing (3)

ITCS 6190 - Cloud Computing for Data Analysis (3)
ITCS 6265 - Advanced Topics in Knowledge Discovery in Databases (3)
ITCS 6345 - Modern Data Science Systems (3)
ITCS 6882 - Individual Study in Data Science (1 to 3)
ITCS 6991 - Computer Science Thesis (1 to 3)

Information Security and Privacy Concentration (ISPC)
Required Course
ITIS 6200 - Principles of Information Security and Privacy (3)

Elective Courses
Select two of the following:
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5250 - Computer Forensics (3)
ITIS 5260 - Introduction to Security Analytics (3)
ITIS 6150 - Software Assurance (3)
ITIS 6167 - Network Security (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6240 - Applied Cryptography (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6420 - Usable Security and Privacy (3)

Software, Systems, and Networks Concentration (SSNC)
Select three of the following:
ITCS 5102 - Survey of Programming Languages (3)
ITCS 5133 - Numerical Computation Methods and Analysis (3)
ITCS 5145 - Parallel Computing (3)
ITCS 5180 - Mobile Application Development (3)
ITCS 5182 - Introduction to High Performance Computing (3)
ITCS 6112 - Software System Design and Implementation (3)
ITCS 6132 - Modeling and Analysis of Communication Networks (3)
ITCS 6166 - Computer Communications and Networks (3)
ITCS 6167 - Advanced Networking Protocols (3)
ITCS 6168 - Wireless Communication Networks (3)
ITCS 6182 - Computer System Architecture (3)
ITCS 6190 - Cloud Computing for Data Analysis (3)
ITCS 6883 - Individual Study in Software, Systems, and Networks (1 to 3)
ITCS 6991 - Computer Science Thesis (1 to 3)
ITIS 5166 - Network-Based Application Development (3)
ITIS 5280 - Advanced Mobile Application Development (3)
ITIS 6167 - Network Security (3)
ECGR 5101 - Advanced Embedded Systems (3)
ECGR 5124 - Digital Signal Processing (3)
ECGR 6181 - Embedded Operating Systems (3)

Dual Concentration
Students may request to complete two concentrations. However, no course can count towards two concentrations.

Elective Courses (0 to 15 credit hours)
Students who select no concentration must complete 15 credit hours of elective courses. Students who select a concentration must complete 6 credit hours or of elective courses. Students who chose to declare dual concentration will not need elective courses. Students may choose from the following elective courses:

ITCS 5000 - ITCS 6999
ITIS 5000 - ITIS 6999
DSBA 5000 - DSBA 6999

Capstone (3 credit hours)
Select one of the following courses. Credit hours from a capstone course may be counted towards a concentration requirement, too, if the same course is listed in that concentration. For students pursuing the M.S. Thesis, they will have to enroll in ITCS 6991 in two consecutive semesters (6 credit hours total), with the 3 credit hours satisfying the capstone requirement.

ITCS 5180 - Mobile Application Development (3)
ITCS 5231 - Advanced Game Design and Development (3)
ITCS 5232 - Game Design and Development Studio (3)
ITCS 6112 - Software System Design and Implementation (3)
ITCS 6880 - Individual Study (1 to 3)
ITCS 6881 - Individual Study in AI, Robotics, and Gaming (1 to 3)
ITCS 6882 - Individual Study in Data Science (1 to 3)
ITCS 6883 - Individual Study in Software, Systems, and Networks (1 to 3)
ITCS 6991 - Computer Science Thesis (1 to 3)
ITIS 5166 - Network-Based Application Development (3)

Degree Total = 30 Credit Hours

Grade Requirements
Core Courses must each be passed with A or B grades. A minimum overall 3.0 GPA is required.

Assistantships
Financial assistance for qualified students is available on a competitive basis in the form of graduate teaching and research assistantships. All M.S. students who entered "Yes" in the application form on the question "Assistantship Interest" are automatically considered. No separate assistantship application is required.

Graduate Certificate in Applied Artificial Intelligence

The Graduate Certificate in Applied Artificial Intelligence (AAI) provides graduate students with the opportunity to reach a demonstrated level of competence in the area of Artificial Intelligence and apply such knowledge to the solution of practical problems. Coursework towards the Certificate in AAI can be used for credit towards the M.S. in Computer Science degree. However, its primary purpose is to provide a well-defined target for students who want to advance their knowledge of modern AI systems and techniques but do not necessarily wish to complete all requirements for the M.S. in Computer Science. The certificate may be pursued concurrently with any of the graduate degree programs at UNC Charlotte.

Admission Requirements

The Certificate in Applied Artificial Intelligence is open to all students who hold a B.S. degree in any scientific, engineering, or business discipline and either are enrolled and in good standing in a graduate degree program at UNC Charlotte or have GPA above 2.8 overall and 3.0 for their Junior and Senior years.

In addition, the program requires a current working knowledge of two higher-level languages, including at least one procedural language; and a familiarity with computer applications. The following minimal background in mathematics is also required: two semesters of calculus and one semester of discrete structures. Individuals who have worked at a high professional level in the computer industry may be able to substitute work experience for specific subject area admission requirements.

Certificate Requirements

The certificate will be awarded upon completion of four graduate level courses (12 credit hours) in the area of artificial intelligence, machine learning, and their applications.

Required Courses (6 credit hours)

ITCS 6114 - Algorithms and Data Structures (3)
ITCS 6150 - Intelligent Systems (3)
or ITCS 5153 - Applied Artificial Intelligence (3)

Elective Courses (6 credit hours)

Select two of the following:
ITCS 6156 - Machine Learning (3)
or ITCS 5156 - Applied Machine Learning (3)
ITCS 6158 - Natural Language Processing (3)
or ITCS 5111 - Introduction to Natural Language Processing (3)
ITCS 6100 - Big Data Analytics for Competitive Advantage (3)
ITCS 6155 - Knowledge-Based Systems (3)
ITCS 6157 - Visual Databases (3)
ITCS 6160 - Database Systems (3)
ITCS 6162 - Knowledge Discovery in Databases (3)
ITCS 6190 - Cloud Computing for Data Analysis (3)
ITCS 6265 - Advanced Topics in Knowledge Discovery in Databases (3)
ITCS 6881 - Individual Study in AI, Robotics, and Gaming (1 to 3)
ITIS 5510 - Web Mining (3)
ITIS 6220 - Data Privacy (3)

Grade Requirements

A cumulative GPA of 3.0 is required, and at most one course with a grade of C may be allowed towards the certificate.

Certificate Total = 12 Credit Hours

Graduate Certificate in Game Design and Development

The Graduate Certificate in Game Design and Development (GDD) provides graduate students with the opportunity to reach a demonstrated level of competence in game design and development. Coursework towards the certificate in GDD can be used towards the M.S. in Computer Science degree. However, its primary purpose is to provide a well-defined target for students who want to advance their knowledge of modern game design and development techniques and work with a variety of professionals, from artists to writers, to bring the vision for an interactive game or media product to life. The certificate may be pursued concurrently with any of the graduate degree programs at UNC Charlotte.

Admission Requirements

This certificate program is open to all students who hold a B.S. degree in any scientific, engineering, or business discipline and one of the following:

1) Are enrolled and in good standing in a graduate degree program at UNC Charlotte
2) Have a GPA above 2.8 overall and 3.0 Junior/Senior

In addition, the program expects a current working knowledge of two higher level languages, including at least one procedural language, and a familiarity with computer applications. The following minimal background in mathematics is compulsory: two semesters of calculus and one semester of discrete structures. Individuals who have worked at a high professional level in the computer

industry may be able to substitute work experience for specific subject area admission requirements. Application for the GDD certificate program is made through the Graduate Admissions Office of the University.

Courses used to satisfy requirements of a previous degree are not acceptable. Students with significant game-related work at the undergraduate level may be allowed to substitute advanced game courses for compulsory courses at the discretion of the GDD certificate coordinators. *(Note: the admission process for the Certificate is separate from the admission process for the M.S. degree.)*

Certificate Requirements

The certificate is awarded upon completion of five graduate level courses (15 credits) in the area of game design and development. Course substitutions may be made at the discretion of the GDD Program Director.

Required Courses (12 credit hours)

ITCS 5230 - Introduction to Game Design and Development (3)
ITCS 5231 - Advanced Game Design and Development (3)
ITCS 5232 - Game Design and Development Studio (3)
ITCS 6120 - Computer Graphics (3)

Elective Course (3 credit hours)

Select one of the following:
ITCS 5235 - Game Engine Construction (3)
ITCS 5236 - Artificial Intelligence for Computer Games (3)
ITCS 5237 - Audio Processing for Entertainment Computing (3)
Another game-related course (generally from ITCS/ITIS at the 5000 level or above) approved by the GDD Program Director

Certificate Total = 15 Credit Hours

Grade Requirements

A cumulative GPA of 3.0 is required, and at most one course with a grade of C may be allowed towards the certificate.

COMPUTING AND INFORMATION SYSTEMS

- Ph.D. in Computing and Information Systems
  - Bioinformatics
  - Business Information Systems and Operations Management
  - Computer Science
  - Design Computation
  - Software and Information Systems
  - Interdisciplinary

College of Computing and Informatics

cci.charlotte.edu

Ph.D. in Computing and Information Systems

The Ph.D. in Computing and Information Systems (CIS) program has six concentrations:

1) Bioinformatics (BINF)
2) Business Information Systems and Operations Management (BISOM)
3) Computer Science (CS)
4) Design Computation (DC)
5) Software and Information Systems (SIS)
6) Interdisciplinary (INT)

In addition, the Ph.D. in CIS offers an Advanced Standing Option for the Concentrations in CS and SIS for students who have already earned a Master's degree in select disciplines.

The program is staffed with a multidisciplinary faculty and offers opportunities for students to develop advanced competencies in a number of CIS-related fields. Faculty from the Departments of Computer Science, Software and Information Systems, Bioinformatics and Genomics, and Business Information Systems and Operations Management form its core. Students, in cooperation with faculty advisors, design flexible programs of study tailored to address individual career goals.

Students who aspire to academic research and teaching can benefit from a strong research faculty of international stature and exposure to practical applications of their specialties. Others seeking employment in industry,

commerce, or government are afforded the opportunity to participate in high-quality applied research.

Admission Requirements

General Admission Requirements

Admission is competitive. Preference is given to applicants with strong credentials and appropriate undergraduate and/or professional preparation. Specific admission requirements for the program include:

1) A baccalaureate degree from a recognized institution. Students must show evidence of preparation in their chosen field sufficient to ensure profitable graduate study.
2) A satisfactory past academic performance as usually reflected by a grade point average of (or equivalent to) at least 3.0 (on a 4.0 scale) on courses related to the chosen field of Ph.D. study.
3) Excellent GRE or GMAT scores.
4) Applicants whose native language is not English must score at least 83 on the Internet-based version, 220 on the computer-based version, or 557 on the paper-based version of the Test of English as a Foreign Language (TOEFL). In addition, they will be required to take an English Proficiency Examination prior to the beginning of the first semester of study. Students who do not pass this examination must pass ENGL 1100 (English as a Foreign Language) with a grade of B or higher.
5) A one-page essay that addresses the following:
    a) The applicant's motivation
    b) Area(s) of research interest
6) Three letters of reference from professionals working in the applicant's field of interest that address the applicant's previous experience and potential to do research.

Further documentation that will support the application may include: evidence of scholarly and creative activity, including publication list; awards; results in national or international contests related to computing and information systems and the like.

Highly qualified individuals who may not meet all the required prerequisites may be admitted with a clear agreement to make up the prerequisites.

GRE/GMAT Waiver

The GRE or GMAT requirement may be waived for applicants if one of the following conditions is met:

- Applicant is a UNC Charlotte student or alumnus/a of the College of Computing and Informatics in undergraduate or graduate studies
- Applicant can provide evidence that they have worked in the computing or information technology industry in the U.S. for 5 or more years
- Applicant obtained an M.S. degree from a U.S. institution accredited by an accepted accrediting body with a minimum GPA of 3.2 in a computing-based major such as:
    - Computer Science
    - Software and Information Systems
    - Computer Engineering
    - Electrical Engineering
    - Applied Mathematics
    - Statistics

Note: If an applicant receives GRE waiver, this is not an indication that they have been admitted to the Ph.D. program.

Concentration Specific Admission Requirements

Business Information Systems and Operations Management Concentration and Software and Information Systems Concentrations

Additional admission requirements for the Business Information Systems and Operations Management concentration and Software and Information Systems concentration include:

1) Adequate understanding of software/information systems analysis, design, and implementation
2) Evidence of college-level skills in mathematical logic and data analysis (e.g., statistics, differential and integral calculus, discrete math, linear algebra)

Computer Science Concentration

Additional admission requirements for the Computer Science concentration include:

Coursework

Incoming students should possess a Master's or at least a Bachelor's degree in Computer Science, Computer Engineering, or a closely related discipline. Specifically, students should have demonstrable knowledge in at least four of the following areas:

1) Algorithms and Data Structures
2) Theory of Computation
3) Programming Language Concepts
4) Computer Architecture
5) Operating Systems
6) Software Engineering and Design

Course requirements may be satisfied through prior undergraduate or graduate work, or by a satisfactory score on the Computer Science Subject GRE examination. Admission into the Computer Science concentration is highly competitive. Thus, satisfying the requirements listed above does not guarantee admission.

Exceptionally strong students from other disciplines will be

considered and may be allowed to make up the deficiencies at the discretion of the CS Ph.D. Admissions Committee.

Research
Prior research experience and strong recommendation letters (preferably from university faculty or researchers at corporate labs) will be a significant consideration in evaluating the applicant's research potential. Research experience maybe demonstrated via publications, Bachelor's or Master's theses. A good match with faculty research interests as well as faculty input to the Admissions Committee will play a significant role in the final decision. Potential applicants are encouraged to communicate with research faculty regarding their interests.

Advanced Standing Option Admission Requirements

To be admitted into the Advanced Standing Option for the CIS Ph.D. program, applicants must meet all the admission requirements of the Ph.D. stated above and must have earned a Master's degree in one of the following:

- Computer Science
- Software and Information Systems
- Computer Engineering

Only students who have earned a Master's degree in these areas will be considered, no exceptions will be made. All other students should apply to the CIS Ph.D. (without the Advanced Standing Option).

Application Deadlines

Application deadlines are in accordance with UNC Charlotte Graduate School deadlines. However, to ensure full consideration for financial support, applications must be received by September 1 for Spring admission and February 1 for Fall admission.

Degree Requirements (without Advanced Standing)

The Ph.D. in Computing and Information Systems program prepares students to be well-rounded professionals in the broad discipline of Computing and Information Systems (CIS). The degree of Doctor of Philosophy is granted for performance of original research resulting in significant contributions to the discipline's body of knowledge. Students are admitted into a concentration within the program by one of the participating units:

1) Department of Computer Science
2) Department of Software and Information Systems
3) Department of Bioinformatics and Genomics
4) Department of Business Information Systems and Operations Management

The Ph.D. in Computing and Information Systems program also has an interdisciplinary concentration in which CIS is applied to different disciplines. Students in the interdisciplinary concentration are admitted into one unit but are expected to complete some coursework in a complementary discipline in addition to the minimum core requirements of their chosen unit. Students in the interdisciplinary concentration must have co-advisors from their chosen unit and the complementary discipline. The detailed requirements are provided below. Failure to satisfy the requirements may result in the student's termination from the program.

To earn a Ph.D. degree, students in all concentrations must complete at least 72 post-baccalaureate credit hours. This includes at least 18 credit hours of dissertation research and at least 9 credit hours of coursework completed at UNC Charlotte. A limited amount of transfer credit is allowed (see below for details). Students are expected to acquire a sufficiently broad body of technical knowledge in the discipline as well as a deep understanding of a specialized area. Such courses will be defined by the student's advisor(s). Students are expected to excel in all coursework. Graduation requirements mandate that students must achieve a minimum grade point average of 3.0 to graduate. Receiving more than two C grades or a grade of U in any course will result in a suspension from the program.

Introductory Course (3 credit hours)

ITSC 8110 Introduction to Computing and Information Systems Research (3)

First-year students must take this introductory course in the first Fall semester. It is jointly taught by CIS Ph.D. faculty for all concentrations, providing new students an overview of the CIS research areas and opportunities at UNC Charlotte.

Only when there is an unavoidable schedule conflict between ITSC 8110 and another Ph.D. level course that a student has to take, can the student make a request to take ITSC 8110 in the second Fall semester. Such a request must be justified and signed by the student's initial Ph.D. advisor and endorsed by the Ph.D. Program Director.

Graduate Research Seminar (minimum 3 credit hours)

ITSC 8699 Graduate Research Seminar (1)

Students must sign up for and receive credit for ITSC 8699 every semester that they are in the Ph.D. program until they are admitted to Ph.D. candidacy.

If there is a legitimate reason that a student has to do part of their Ph.D. research in a different site during a regular

semester, then they must first make a request to be exempted from taking ITSC 8699 for the period that they are visiting the other site. Such a request must be well justified and signed by the student's Ph.D. advisor and endorsed by the Concentration Coordinator. The period of exemption should not exceed one semester. Exceptions must be approved by the Ph.D. Steering Committee.

Concentration Requirements

Bioinformatics Concentration

Required Courses (25 credit hours)

Students must take the following courses prior to the qualifying exam:

BINF 8100 - Biological Basis of Bioinformatics (3)
BINF 8101 - Energy and Information in Biological Modeling (3)
BINF 8111 - Bioinformatics Programming I (3)
BINF 8112 - Bioinformatics Programming II (3)
BINF 8200 - Statistics for Bioinformatics (3)
BINF 8201 - Molecular Sequence Analysis (3)
BINF 8202 - Computational Structural Biology (3)
BINF 8911 - Bioinformatics Research Rotation I (2)
BINF 8912 - Bioinformatics Research Rotation II (2)

Elective Courses (24 credit hours)

Select from the following:

BINF 8000-8999 - Bioinformatics Elective
ITCS 8000-8999 - Computer Science Elective
ITIS 8000-8999 - Software and Information Systems Elective
ITSC 8000-8999 - Computing and Informatics Elective

Note: Students with exceptionally strong backgrounds in specific disciplines may be excused from one or more of the required didactic classes (except ITSC 8110) at the discretion of the Bioinformatics Concentration Coordinator.

Business Information Systems and Operations Management Concentration

In addition to the general CIS Ph.D. program requirements, students must also take:

Required Coursework (minimum 36 credit hours)

Take at least 36 credit hours of coursework approved by the student's Research Advisor(s). At least 9 credit hours of graduate coursework must be taken at UNC Charlotte. (Exceptions to minimum credit hour requirements may be granted by the Department's Graduate Affairs Committee upon the recommendation of the student's advisor. Such a request should only be granted based on overwhelming evidence that the student has excellent background knowledge to conduct high quality research in Computing and Information Systems.)

Dissertation Research (minimum 18 credit hours)

ITSC 8991 - Doctoral Dissertation Research (1 to 9)

Computer Science Concentration

Core Courses (12 credit hours)

The GPA of these four core courses must be 3.5 or above. Core course requirements must be met within the first 30 credit hours of entering the program.

Group A (6 credit hours)
Select two of the following:

ITCS 8107 - Formal Languages and Automata (3)
ITCS 8114 - Algorithms and Data Structures (3)
ITCS 8132 - Modeling and Analysis of Communication Networks (3)
ITCS 8156 - Machine Learning (3)
ITCS 8165 - Coding and Information Theory (3)

Group B (6 credit hours)
Select two of the following:

ITCS 8120 - Computer Graphics (3)
ITCS 8150 - Intelligent Systems (3)
ITCS 8160 - Database Systems (3)
ITCS 8166 - Computer Communications and Networks (3)
ITCS 8182 - Computer System Architecture (3)

Elective Courses (30 credit hours)

With advisor approval, select from the following:

ITCS 8XXX - Computer Science Elective (3)
ITIS 8XXX - Software and Information Systems Elective (3)
ITSC 8XXX - Computing and Informatics Elective (3)
(excluding ITSC 8699, ITSC 8990, and ITSC 8991)

Pre-Dissertation Research (minimum 6 credit hours)

Students take during their first four semesters under the direction of one or more CIS Ph.D. Graduate Faculty members.

ITSC 8990 Pre-Dissertation Research (1 to 6)

Dissertation Research (minimum 18 credit hours)

Take under the direction of one or more CIS Ph.D. Graduate Faculty members.

ITSC 8991 Doctoral Dissertation Research (1 to 9)

Design Computation Concentration

The Design Computation concentration is an in-depth interdisciplinary program between the College of Computing and Informatics and the School of Architecture. The program is grounded in both critical theory and applied research, at the intersection of design, computation, and informatics, with two primary foci: (1) Computation as Design Inquiry and (2) Computation as Enabling Medium.

Computation as Design Inquiry investigates application of computing in design with research topics, including: computational methods, theories, and tools for design, fabrication, optimization, and construction automation; artificial intelligence, cognitive science, and computational theories in design.

Computation as Enabling Medium investigates the application of computing to enhance the human experience of the built environment. Research topics in this area include: intelligent systems, interfaces, and mechanisms for social consciousness, participation, and cooperation in building, urban, infrastructure, and mobility systems; computational modeling for urban resilience; and ethical questions that rise from human-in-the-loop synergies.

The curriculum balances technical rigor with theoretical foundations in an immersive project-based education and combines courses from Architecture, Computer Science, Software Information Systems, and Data Science. Applicants are expected to clearly articulate research topics during their application to their program. Admitted students should have a co-advisors and members of their dissertation committees from the faculty of both the College of Arts + Architecture (CoA+A) and the College of Computing and Informatics (CCI).

Primary research topics include:

- Urban Resilience through Pervasive Computing
- Human Building Interaction
- Computational Design Manufacturing and Robotics

Core Courses (30 credit hours)

GRAD 8302 - Responsible Conduct of Research (2)
GRAD 8990 - Academic Integrity (0)
ITSC 8110 - Introduction to Computing and Information Systems Research (3)
ITSC 8699 - Graduate Research Seminar (1) *(taken every semester until proposal; 3+ credit hours)*
ITSC 8990 - Pre-Dissertation Research (1 to 6) *(taken for 6+ credit hours)*
ITSC 8991 - Doctoral Dissertation Research (1 to 9) *(taken for 18+ credit hours)*

Design Computation Concentration Core Courses (19 credit hours)

ARCH 8004 - Architectural History Topics (3) *(Design Computation Theory)*
ARCH 7211 - Studio Lab I (4 to 6)
or ARCH 8211 - Studio Lab (4)
or ITCS 6211 - Studio Lab I (4)
or ITIS 6211 - Studio Lab I (3)
or ARCH 7212 - Studio Lab II (4 to 6)
or ITCS 6212 - Studio Lab II (4)
or ITIS 6212 - Studio Lab II (3)

Architecture Course (3 credit hours)
Select one of the following:
ARCH 8050 - Architectural Elective: Connective Environments I (3)
ARCH 8607 - Digital Manufacturing and Robotics (3)

Software and Information Systems Course (3 credit hours)
Select one of the following:
ITIS 5166 - Network-Based Application Development (3)
ITIS 5180 - Mobile Application Development (3)
ITIS 8400 - Human-Centered Design (3)
ITIS 8520 - Network Science (3)

Computer Science Course (3 credit hours)
Select one of the following:
ITCS 8124 - Illustrative Visualization (3)
ITCS 8125 - Virtual and Augmented Reality (3)
ITCS 8162 - Knowledge Discovery in Databases (3)

Data Science Course (3 credit hours)
Select one of the following:
DSBA 5510 - Web Mining (3)
DSBA 6100 - Big Data Analytics for Competitive Advantage (3)
DSBA 6156 - Applied Machine Learning (3)

Design Computation Concentration Elective Courses (23 credit hours)

Select from ITCS, ITIS, ARCH, or DSBA courses.

Software and Information Systems Concentration

Core Courses (9 credit hours)
A GPA of 3.6 or above is required for these courses. Advanced versions of the core courses can be used as substitutes upon permission from both the student's academic advisor and the program coordinator. Core course requirements must be met during the first 30 credit hours within the program.

Select three of the following:
ITIS 8180 - Foundations of Health Informatics (3)
ITIS 8200 - Principles of Information Security and Privacy (3)
ITIS 8400 - Human-Centered Design (3)
ITIS 8520 - Network Science (3)

Elective Courses (30 credit hours)
With advisor approval, select from the following:

ITCS 8XXX - Computer Science Elective (3)
ITIS 8XXX - Software and Information Systems Elective (3)
ITSC 8XXX - Computing and Informatics Elective (3) *(excluding ITSC 8699, ITSC 8990, and ITSC 8991)*

Pre-Dissertation Research (minimum 6 credit hours)
Students take during their first four semesters under the direction of one or more CIS Ph.D. Graduate Faculty

members.

ITSC 8990 - Pre-Dissertation Research (1 to 6)

Dissertation Research (minimum 18 credit hours)
Take under the direction of one or more CIS Ph.D. Graduate Faculty members.

ITSC 8991 - Doctoral Dissertation Research (1 to 9)

Interdisciplinary Concentration

The coursework requirements of this concentration depend on the chosen unit and complementary discipline. Students in this concentration must select Computer Science (CS) or Software and Information Systems (SIS) as their home unit. The core courses of that unit applies to them.

Computer Science Core Courses (12 credit hours)
Group A (6 credit hours)
Select two of the following:
ITCS 8107 - Formal Languages and Automata (3)
ITCS 8114 - Algorithms and Data Structures (3)
ITCS 8132 - Modeling and Analysis of Communication Networks (3)
ITCS 8156 - Machine Learning (3)
ITCS 8165 - Coding and Information Theory (3)

Group B (6 credit hours)
Select two of the following:
ITCS 8120 - Computer Graphics (3)
ITCS 8150 - Intelligent Systems (3)
ITCS 8160 - Database Systems (3)
ITCS 8166 - Computer Communications and Networks (3)
ITCS 8182 - Computer System Architecture (3)

Software and Information Systems Core Courses (9 credit hours)
Select three of the following:
ITIS 8180 - Foundations of Health Informatics (3)
ITIS 8200 - Principles of Information Security and Privacy (3)
ITIS 8400 - Human-Centered Design (3)
ITIS 8520 - Network Science (3)

Elective Discipline Courses
Beyond the core requirements of the chosen unit, students must select a minimum of two graduate courses from a complementary discipline with the approval of their advisors.

Degree Total = 72 Credit Hours

Degree Requirements (with Advanced Standing Option)

Students with a Master's degree in Computer Science, Software and Information Systems, or Computer Engineering may be accepted into the Advanced Standing Option for the CIS Ph.D. under the Concentrations in Computer Science or Software and Information Systems.

The degree requirements for the Advanced Standing Option are similar to the CIS Ph.D., except that students must complete only 42 credit hours. No transfer credit is allowed under this program.

Introductory Course (3 credit hours)

ITSC 8110 - Introduction to Computing and Information Systems Research (3)

Graduate Research Seminar (minimum 3 credit hours)

ITSC 8699 - Graduate Research Seminar (1)

Dissertation Research (minimum 18 credit hours)

ITSC 8991 - Doctoral Dissertation Research (1 to 9)

Concentration Core Courses (6 credit hours)

Computer Science Concentration
Group A
Select one of the following:
ITCS 8107 - Formal Languages and Automata (3)
ITCS 8114 - Algorithms and Data Structures (3)
ITCS 8132 - Modeling and Analysis of Communication Networks (3)
ITCS 8156 - Machine Learning (3)
ITCS 8165 - Coding and Information Theory (3)

Group B
Select one of the following:
ITCS 8120 - Computer Graphics (3)
ITCS 8150 - Intelligent Systems (3)
ITCS 8160 - Database Systems (3)
ITCS 8166 - Computer Communications and Networks (3)
ITCS 8182 - Computer System Architecture (3)

Software and Information Systems Concentration
Select two of the following:
ITIS 8180 - Foundations of Health Informatics (3)
ITIS 8200 - Principles of Information Security and Privacy (3)
ITIS 8400 - Human-Centered Design (3)
ITIS 8520 - Network Science (3)

Concentration Elective Courses (6 credit hours)

Select two of the following:
ITCS 8XXX - Computer Science Elective (3)
ITIS 8XXX - Software and Information Systems Elective (3)
ITSC 8XXX - Computing and Informatics Elective (3)
(excluding ITSC 8699, ITSC 8990, and ITSC 8991)

Additional Elective Courses (minimum 6 credit hours)
A minimum of 42 credit hours are required to complete the degree. Once the above course requirements have been met, the remaining credit hours can be satisfied via coursework, pre-dissertation research (up to 6 credit hours of ITSC 8990), or research credit hours (ITSC 8991).

Degree Total = 42 Credit Hours

Research Advisor(s) and Qualifying Exam Committee

Each Ph.D. student is assigned a temporary academic advisor(s) within a concentration when admitted to the program. Before the end of their fourth semester in the program, students should select a Research Advisor(s) and, in consultation with their Research Advisor(s), form a Qualifying Exam Committee. The Qualifying Exam Committee should include at least three CIS Doctoral Faculty members, plus the student's the Research Advisor who is a non-voting member of the Qualifying Exam Committee. The Qualifying Exam Committee must be approved by the Concentration Coordinator.

Qualifying Examination

Each student must pass a Qualifying Examination, given and evaluated by the student's Qualifying Exam Committee. The purpose of the Qualifying Exam is to ensure that the student will have sufficient capability for doing dissertation-level research leading to a Ph.D. degree.

Each student must prepare a written research survey that describes the research area the student is expected to do their dissertation research in. Copies of the research survey must be provided to the committee at the time of filing the Qualifying Examination application, which must be at least two weeks prior to the exam. Each student must present their research survey and defend it in a manner accepted by the Qualifying Exam Committee. Prior to the oral defense of the research survey, the student's advisor is required to submit a written evaluation of the student's research and academic progress to the Qualifying Exam Committee, with a copy also provided to the Concentration Coordinator. The Qualifying Exam is graded on a Pass/Unsatisfactory basis, based on the corresponding rubrics by the Qualifying Exam Committee. A pass decision must be unanimous.

Students must pass the Qualifying Examination in at most two attempts within three years of the date of first enrollment into Ph.D. study at UNC Charlotte. Students in the Advanced Standing Option must take the Qualifying Examination before the end of their first year in the doctoral program. A student who fails the Qualifying Exam twice will be terminated from the Ph.D. in Computing and Information Systems program.

Dissertation Committee

After passing the qualifying exam, the student should set up a Dissertation Committee of at least four graduate faculty members, which include at least three Ph.D. in Computing and Information Systems faculty members. This Committee may, but is not required to, consist of the same faculty members as the Qualifying Exam Committee. Ordinarily, the chair of this committee will be the student's advisor(s), who must be a member of the CIS Ph.D. program faculty and will ensure that the composition of the committee is appropriate. Committee members from outside the University must be appointed Associate Graduate Faculty members at UNC Charlotte. The Dissertation Committee must be approved by the Concentration Coordinator. After identifying and obtaining the signatures of the CIS faculty who will be serving on the Committee, the Dissertation Committee Form must be sent to the Graduate School for the appointment of the Graduate Faculty Representative. This appointment may take as long as four weeks. If there is need to change committee members later, a formal written request must be first submitted to the CIS Ph.D. Steering Committee with a clear explanation of the rationale for change. Upon approval by the CIS Ph.D. Steering Committee, a revised Committee form (above) must be submitted.

Proposal Defense

Each student must present and defend a Ph.D. dissertation proposal after passing the qualifying exam and within ten semesters since entering the Ph.D. program. The proposal defense will be conducted by the student's Dissertation Committee and will be open to the CIS Ph.D. faculty and students. The student shall provide copies of the written proposal to the Committee members at least two weeks before the scheduled defense. At the discretion of the Dissertation Committee, the defense may include questions that cover the student's program of study and background knowledge in the area of the proposal. The proposal defense will be graded on a Pass/Unsatisfactory basis, according to the corresponding rubrics by the Committee. A pass must be a unanimous decision by the Committee members; otherwise, the proposal defense fails. A student may retake the proposal defense if they cannot pass it the first time, and should consult the Concentration Coordinator before the second attempt. The second failed defense of a dissertation proposal will result in the termination of the student's enrollment in the Ph.D. program. It is expected that the student first take the proposal defense by the ninth semester after they are enrolled, in order to provide time for a second attempt should the first one fail.

Ph.D. Candidacy

A doctoral student advances to Ph.D. candidacy after the dissertation proposal has been successfully defended.

Dissertation

Each student must complete a research program approved by the student's Dissertation Advisor(s) that yields a high quality, original, and substantial piece of research. The Ph.D. dissertation describes this research and its results. The dissertation defense is a public presentation. A written copy of the dissertation must be made available to each member of the student Ph.D. Dissertation Committee, to the Ph.D. Steering Committee, and to the UNC Charlotte Library, at least three weeks before the public defense. The date of the defense must be publicly announced at least three weeks prior to the defense. The student must present the dissertation and defend it in a manner accepted by the Dissertation Committee. The dissertation will be graded on a Pass/Unsatisfactory basis, based on the corresponding rubrics by the Dissertation Committee. A pass decision must be unanimous and must be approved by the Dean of the Graduate School. A student who fails the defense of a dissertation twice will be terminated from the Ph.D. in Computing and Information Systems program.

Progress Report and Evaluation

By every January, each student is required to submit a written progress report for the previous year, and the advisor(s) is required to submit a written evaluation of the student to the Concentration Coordinator, with a copy to the Program Director. A rubric is used for evaluation of progress. Failure to make satisfactory progress may result in discontinuation of the student's graduate assistantship and suspension from the program.

Residency Requirements

Each student must satisfy the residency requirement of one continuous full-time year (i.e., two consecutive semesters with the student being enrolled for at least nine graduate credit hours in each semester) after being admitted to the Ph.D. degree program.

Transfer Credit

In accordance with rules of the UNC Charlotte Graduate School, students are allowed to transfer up to 30 credit hours of graduate credit earned at UNC Charlotte or other recognized graduate programs. In cases of applicants with records of exceptionally high quality, the CIS Ph.D. Steering Committee, at its discretion, may request that the Graduate School approve transfer credit beyond the limit set by the Graduate School. To receive transfer credit, students must file a written request and submit all necessary documents to the Concentration Coordinator.

Note: Transfer credit is not accepted under the Advanced Standing Option.

SOFTWARE AND INFORMATION SYSTEMS

- M.S. in Cybersecurity
- M.S. in Information Technology
  - Advanced Data and Knowledge Discovery
  - Emerging Technologies
  - Human-Centered Design
  - Information Security and Privacy
  - Information Technology Management
  - Software Systems Design and Engineering
  - Web Development
- Master of Architecture and M.S. in Computer Science or Information Technology Dual Degree *(see under Architecture in the "College of Arts + Architecture" section)*
- Graduate Certificate in Health Informatics and Analytics *(see under Health Informatics)*
- Graduate Certificate in Information Security and Privacy
- Graduate Certificate in Management of Information Technology
- Graduate Certificate in Network Security
- Graduate Certificate in Secure Software Development
- Graduate Certificate in Software Development

Department of Software and Information Systems

sis.charlotte.edu

M.S. in Cybersecurity

The Master of Science in Cybersecurity is designed to equip students with the latest knowledge and skills in cybersecurity and privacy. Graduates of the program are employable by both businesses and governments that have important information assets to be protected from increasingly sophisticated cyber-attacks.

Specific educational objectives of the program include:

- A fundamental understanding of:
  - common vulnerabilities of computing and networked systems,
  - cyber-attacking methods,
  - human and organizational aspects of cybersecurity,
  - methods for compromising privacy, and
  - risk assessment of cyber-attacks.
- Able to apply security techniques to analyze and evaluate the security risk of information systems and networks.
- Able to design information systems and networks with security controls to minimize security risks.

The program requires students to take four core courses and six elective courses. The core courses are designed to prepare students with fundamental knowledge and skills in cybersecurity and privacy protection that are essential to all cybersecurity professionals. The elective courses give students an opportunity to broaden their knowledge and skills in major areas of cybersecurity. Together, these two components equip students with necessary skill sets in specific areas in cybersecurity and privacy where they wish to pursue their professional careers.

Students entering the Master of Science in Cybersecurity program are required to have completed a baccalaureate degree from a college or university accredited by an accepted accrediting body and have acquired substantial experience in studying, applying, or developing information and computing technology. Such experience may be developed by completing an undergraduate major in a discipline related to information technology, including but not limited to: business information systems, computer engineering, computer science, data communication, information management, information technology, mathematical and physical sciences, and software engineering. For applicants who have an undergraduate major not directly related to computing, the experience may be acquired through work, professional training, or further education such as graduate certificates or post baccalaureate studies.

Admission Requirements

Admission requirements specific to the program include:

- Undergraduate or equivalent coursework in (a) data structures, (b) object-oriented programming in C++, C#, or java, (c) databases, (d) computer networks and (e) web application development, all with minimum GPAs of 3.0 on a 4.0 scale. Applicants who have substantial work experience in applying or developing computing and information technology may be able to substitute their work experience for the above specific requirements, subject to review by the Graduate Program Director.
- Undergraduate GPA or equivalent of at least 3.0 on a 4.0 scale, and a Junior/Senior GPA of at least 3.0
- Satisfactory score on the aptitude portion of the Graduate Record Examination (GRE) or the Graduate Management Admission Test (GMAT). The GRE/GMAT requirement will be waived for applicants who: 1) Have a cumulative undergraduate or graduate GPA of 3.0 and above from a college or university accredited by an accepted accrediting body, 2) Are currently enrolled in an undergraduate or graduate program at UNC Charlotte, and have completed at least 3 courses successfully with a GPA of 3.2 or better, or 3) Have a minimum of five years of relevant work experience in information technology or related fields in the United States.
- Statement of purpose
- Letters of recommendation

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

Students are required to complete 30 credit hours for the M.S. in Cybersecurity degree program, of which: (a) 12 are for 4 common core courses, (b) 15 are for 5 elective courses in cybersecurity, and (c) 3 are for one elective course in computing and information technology.

Core Courses (12 credit hours)

ITIS 5250 - Computer Forensics (3)
ITIS 6167 - Network Security (3)
ITIS 6200 - Principles of Information Security and Privacy (3)
ITIS 6240 - Applied Cryptography (3)

Elective Courses (18 credit hours)

3 of the 18 required elective credit hours may be substituted by an approved IT Internship, which also serves as a capstone project.

Cybersecurity Elective Courses (15 credit hours)

Select five of the following.
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5246 - Competitive Cyber Defense (3)
ITIS 5260 - Introduction to Security Analytics (3)
ITIS 5331 - Web-Based Mobile and IoT Firmware Security (3)
ITIS 6150 - Software Assurance (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)

ITIS 6260 - Quantum Computing (3)
ITIS 6270 - BlockChain, Cryptocurrency, and Distributed Ledger Technologies (3)
ITIS 6268 - Wireless Network Security (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6330 - Malware Analysis (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6420 - Usable Security and Privacy (3)
ITIS 6880 - Individual Study (1 to 3) *(independent study for a security topic may be repeated, but only 3 credit hours may count towards the degree)*
ITIS 6999 - SFS Research (3) *(may be repeated, but only 3 credit hours may count towards the degree)*

College of Computing and Informatics Elective Course (3 credit hours)
Select any additional graduate course offered by the College of Computing and Informatics.

Capstone Experience
Select one of the following three options to complete the 30-credit hour program:

Coursework + Master's Thesis
24 credit hours of coursework plus 6 credit hours of Master's research thesis project. The thesis option requires the formation of a program committee. The thesis option requires students to perform research under the supervision of an academic advisor, submit a written thesis, and orally defend their work before their program committee.

Coursework + Internship
27 credit hours of coursework plus 3 credit hours of an approved IT Internship. The internship option requires approval by the program director of an internship location and preceptor, and the submission of a written internship report.

Coursework + Project Report
30 credit hours of coursework plus a project report. The project report option requires completion of 30 credit hours of coursework and successfully completing a report describing a project experience in cybersecurity to fulfill the requirements of a culminating experience for the M.S. degree. The report is submitted to and approved by the Graduate Program Director.

Degree Total = 30 Credit Hours

Grade Requirements
Students in the M.S. in Cybersecurity program must maintain a minimum GPA of 3.0 for continued enrollment in the program. Accumulation of three C grades results in suspension from the program. Accumulation of one unsatisfactory (U) grade results in suspension from the program.

M.S. in Information Technology

The Master of Science in Information Technology (MSIT) program is designed to equip students with advanced skills and knowledge in the planning, design, implementation, testing and evaluation, deployment, maintenance, and management of applications and systems, that embody information and communication technologies for their proper functioning. These skills form necessary foundations for solving practical problems that arise in business, industrial, governmental, and other organizations, as well as for pursuing doctoral studies in information technologies.

The current areas of concentration include: Advanced Data and Knowledge Discovery, Emerging Technologies, Human-Centered Design, Information Security and Privacy, Information Technology Management, Software Systems Design and Engineering, and Web Development.

Students entering the MSIT program are required to have completed a baccalaureate degree from a college or university accredited by an accepted accrediting body and have acquired substantial experience in studying, applying, or developing information and computing technology. Such experience may be developed by completing an undergraduate major in a discipline related to information technology, including but not limited to, business information systems, computer engineering, computer science, data communication, information management, information technology, mathematical and physical sciences, and software engineering. For applicants who have an undergraduate major not directly related to computing, the experience may be acquired through work, professional training, or further education such as post baccalaureate studies.

Admission Requirements
Admission requirements specific to the MSIT program include:

1) Applicants must have completed undergraduate or equivalent coursework in (a) data structures and (b) object-oriented programming in C++, C#, or Java, both with a minimum GPAs of 3.0 on a 4.0 scale. Applicants who have substantial work experience in applying or developing computing and information technology may be able to substitute their work experience for the specific requirements for object-oriented programming and/or data structures, subject to review by the MSIT Program Coordinator.
2) All applicants must have an undergraduate GPA or equivalent of at least 3.0 on a scale of 1.0 to 4.0, and a Junior/Senior GPA of at least 3.0.

3) Applicants are required to demonstrate a satisfactory score on the aptitude portion of the Graduate Record Examination (GRE) or the Graduate Management Admission Test (GMAT). UNC Charlotte students with a GPA of 3.0 or above who have completed or are enrolled in a bachelor's degree or graduate certificate program may request a waiver of the GRE or GMAT exams, subject to approval of the Graduate Program Director.

GRE/GMAT Waiver

The GRE/GMAT requirement will be waived for applicants who: (1) Have a cumulative undergraduate or graduate GPA of 3.0 and above from a college or university accredited by an accepted accrediting body; (2) Are currently enrolled in an undergraduate or graduate program at UNC Charlotte, and have completed at least 3 courses successfully with a minimum GPA of 3.2; or (3) Have a minimum of five years of relevant work experience in information technology or related fields in the United States.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Master of Science in Information Technology degree requires a total of 30 graduate credit hours with a minimum GPA of 3.0, together with a capstone or culminating experience. Additionally, the following requirements must be met:

- No more than 12 credit hours of coursework may be taken from outside of the courses offered by the Department of Software and Information Systems
- At least 15 credit hours must be taken from 6000 level or above courses
- No more than 3 credit hours may be taken for Individual Study
- A maximum of 6 graduate credit hours may be transferred from other institutions

The 30 credit hours of coursework comprise the following three parts:

Core Courses (15 credit hours)

Advanced Programming Courses

Select one of the following:

ITIS 5166 - Network-Based Application Development (3)
ITIS 5180 - Mobile Application Development (3)

Software Systems Courses

Select one of the following:

ITIS 6112 - Software System Design and Implementation (3)
ITIS 6177 - System Integration (3)
ITIS 6342 - Information Technology Project Management (3)

Databases and Data Science Courses

Select one of the following:

ITIS 6120 - Applied Databases (3)
ITIS 6162 - Knowledge Discovery in Databases (3)

Principles Courses

ITIS 6200 - Principles of Information Security and Privacy (3)
ITIS 6400 - Human-Centered Design (3)

Concentration Courses (9 credit hours)

The MSIT program offers the following concentrations:

1) Advanced Data and Knowledge Discovery
2) Emerging Technologies
3) Human-Centered Design
4) Information Security and Privacy
5) Information Technology Management
6) Software Systems Design and Engineering
7) Web Development

Each student is required to select one concentration and complete 3 courses selected from the list of approved courses for the specific concentration. Among the 9 credit hours for a concentration, 6 may be substituted with a master's research thesis. The topic for the research thesis must fall within the area of concentration. A core course cannot be double-counted toward a concentration. Subject to the approval of the MSIT Program Director, a course from outside of the approved list for a concentration may be taken as a substitute for a course for the concentration.

Advanced Data and Knowledge Discovery Concentration

Select three of the following:

ITCS 5122 - Visual Analytics (3)
ITCS 6100 - Big Data Analytics for Competitive Advantage (3)
or DSBA 6100 - Big Data Analytics for Competitive Advantage (3)
ITCS 6155 - Knowledge-Based Systems (3)
ITCS 6156 - Machine Learning (3)
ITCS 6157 - Visual Databases (3)
ITCS 6161 - Advanced Topics in Database Systems (3)
ITCS 6190 - Cloud Computing for Data Analysis (3)
ITCS 6265 - Advanced Topics in Knowledge Discovery in Databases (3)
ITCS 6267 - Intelligent Information Retrieval (3)
ITIS 5510 - Web Mining (3)

ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6150 - Software Assurance (3)
ITIS 6162 - Knowledge Discovery in Databases (3)
ITIS 6163 - Data Warehousing (3)
or ITCS 6163 - Data Warehousing (3)
ITIS 6220 - Data Privacy (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6410 - Personalization and Recommender Systems (3)
ITIS 6520 - Network Science (3)
MBAD 6201 - Business Intelligence and Analytics (3)
or DSBA 6201 - Business Intelligence and Analytics (3)
MBAD 6211 - Advanced Business Analytics (3)

Emerging Technologies Concentration
Select three courses from the aggregated list of courses for all the other concentrations. Students are recommended to select each course from a different concentration to maximize their exposure to the broadest range of latest knowledge in computing and information technology.

Human-Centered Design Concentration
Select three of the following:
ITCS 5122 - Visual Analytics (3)
ITCS 5123 - Visualization and Visual Communication (3)
ITIS 5350 - Rapid Prototyping (3)
ITIS 5390 - Interaction Design Studio (3)
ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6211 - Studio Lab I (3)
or ITCS 6211 - Studio Lab I (4)
or ARCH 7211 - Studio Lab I (4 to 6)
ITIS 6212 - Studio Lab II (3)
or ITCS 6212 - Studio Lab II (4)
or ARCH 7212 - Studio Lab II (4 to 6)
ITIS 6216 - Introduction to Cognitive Science (3)
ITIS 6360 - User-Centered Design and Evaluation (3)
ITIS 6370 - Interactive Systems Design and Implementation (3)
ITIS 6410 - Personalization and Recommender Systems (3)
ITIS 6420 - Usable Security and Privacy (3)
ITIS 6880 - Individual Study (1 to 3)
PHIL 6340 - Philosophy of Mind (3)
PSYC 6116 - Cognition (3)

Information Security and Privacy Concentration
Select three of the following:
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5246 - Competitive Cyber Defense (3)
ITIS 5250 - Computer Forensics (3)
ITIS 5260 - Introduction to Security Analytics (3)
ITIS 5331 - Web-Based Mobile and IoT Firmware Security (3)
ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6150 - Software Assurance (3)
ITIS 6167 - Network Security (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6240 - Applied Cryptography (3)
ITIS 6260 - Quantum Computing (3)
ITIS 6268 - Wireless Network Security (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6330 - Malware Analysis (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6420 - Usable Security and Privacy (3)

Information Technology Management Concentration
ITIS 6342 - Information Technology Project Management (3) *(if not already taken as a Core Course)*
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)

Plus 1-2 of the following, to result in 3 courses for this concentration:
ITCS 5161 - Intellectual Property Aspects of Computing (3)
ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6177 - System Integration (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6320 - Cloud Data Storage (3)
MBAD 6122 - Decision Modeling and Analysis via Spreadsheets (3)
MBAD 6141 - Operations Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6164 - Executive Communication (3)
MBAD 6165 - Negotiation and Conflict Management (3)
MBAD 6201 - Business Intelligence and Analytics (3)
or DSBA 6201 - Business Intelligence and Analytics (3)
MBAD 6202 - Managing IT-Enabled Business Processes and Systems (3)
MBAD 6207 - Business Project Management (3)

Software Systems Design and Engineering Concentration
ITIS 6112 - Software System Design and Implementation (3) *(if not already taken as a Core Course)*

Plus 2-3 of the following, to result in 3 courses for this concentration:
ITIS 5166 - Network-Based Application Development (3)
ITIS 5180 - Mobile Application Development (3)
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5280 - Advanced Mobile Application Development (3)
ITIS 5390 - Interaction Design Studio (3)
ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6150 - Software Assurance (3)
ITIS 6177 - System Integration (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6260 - Quantum Computing (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6370 - Interactive Systems Design and Implementation (3)

Web Development Concentration
Select three of the following:
ITIS 5166 - Network-Based Application Development (3)
ITIS 5180 - Mobile Application Development (3)
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5350 - Rapid Prototyping (3)
ITIS 5390 - Interaction Design Studio (3)
ITIS 5510 - Web Mining (3)
ITIS 6010 - Topics in Software and Information Systems (3) *(only if topic applicable and approved by program director)*
or ITCS 6010 - Topics in Computer Science (3) *(only if topic applicable and approved by program director)*
ITIS 6177 - System Integration (3)
ITIS 6360 - User-Centered Design and Evaluation (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6370 - Interactive Systems Design and Implementation (3)
ITIS 6410 - Personalization and Recommender Systems (3)
ITIS 6520 - Network Science (3)

Elective Courses (6 credit hours)
Students fulfill the remaining requirements for coursework by completing two approved elective courses from the College of Computing and Informatics.

Part of the elective requirements may also be met by taking the following internship:

ITIS 6198 - IT Internship Project (3)

Culminating Experience (0-6 credit hours)
All students must successfully complete a culminating experience. This requirement is satisfied by completing any one of the following three:

- **IT Project:** a 15-page written report on knowledge related to one or more courses or a programming experience *(0 credit hours)*
- **IT Internship:** ITIS 6198 - IT Internship Project (3)
- **IT Master's Thesis:** ITIS 6991 - Information Technology Thesis *(6 credit hours; taken for 2 semesters)*

Degree Total = 30 Credit Hours

Graduate Certificate in Human-Computer Interaction

The Graduate Certificate in Human Computer Interaction provides both knowledge and skills in the human-centered design of interfaces for software applications. Students are provided with a basic understanding of human-centered design methods, as well as practical experience with techniques for designing, prototyping, implementing, and evaluating user interfaces.

The certificate is awarded upon completion of four graduate level courses (12 credit hours) in the area of human-computer interaction and design. Requests for related course substitutions may be approved at the discretion of the Graduate Program Director.

The graduate certificate may act as a standalone graduate option for post-baccalaureate and post-master's students, or may be pursued concurrently with a related graduate degree program at UNC Charlotte. The 12 credit hours in the certificate program may be applied to the graduate programs in the Department of Software and Information Systems with approval of the department Graduate Program Director.

All requirements must be completed within five years of studies, starting from the time when the first course for the certificate is taken. Coursework taken for one graduate certificate may not be counted towards a second graduate certificate.

Admission Requirements
This graduate certificate program is open to all applicants who hold a bachelor's degree from a college or university accredited by an accepted accrediting body, with a minimum overall GPA of 2.8 on a 4.0 scale. The requirements on GPA may be waived if an applicant is currently enrolled and in good standing in a graduate degree program at UNC Charlotte. Applicants should also have either a degree in or minimum one year of work experience in computing, digital communication, design, web development, or other related areas.

Certificate Requirements

Core Courses (6 credit hours)

ITIS 5390 - Interaction Design Studio (3)
ITIS 6400 - Human-Centered Design (3)

Elective Courses (6 credit hours)

Select two of the following:

ITIS 5350 - Rapid Prototyping (3)
ITIS 6360 - User-Centered Design and Evaluation (3)
ITIS 6370 - Interactive Systems Design and Implementation (3)
ITIS 6420 - Usable Security and Privacy (3)
ITCS 5121 - Information Visualization (3)
ITCS 5122 - Visual Analytics (3)

Certificate Total = 12 Credit Hours

Grade Requirements

The cumulative GPA for the courses in the program must be a minimum of 3.0.

Graduate Certificate in Information Security and Privacy

The Graduate Certificate in Information Security and Privacy provides professionals with an opportunity to advance their level of competence in the understanding, management, and applications of cybersecurity and privacy technology. Coursework towards this graduate certificate can be used for credit towards the M.S. in Information Technology or M.S. in Cybersecurity. However, its primary objective is to provide a well-defined target for students who want to advance their knowledge and skills in understanding and applying cybersecurity technology, but do not necessarily wish to complete all the requirements for a master's degree. The certificate may be pursued concurrently with any of the graduate degree programs at UNC Charlotte.

Admission Requirements

This graduate certificate program is open to all applicants who hold a bachelor's degree from a college of university accredited by an accepted accrediting body in a computing, mathematical, engineering or business discipline, with a minimum overall GPA of 2.8 and Junior/Senior GPA of 3.0, on a 4.0 scale. In addition, applicants are required to have substantial knowledge of data structures and object-oriented programming in C++, C# or Java.

The requirements on GPA may be waived if an applicant is currently enrolled and in good standing in a graduate degree program at UNC Charlotte.

As part of an application for the graduate certificate program, applicants are required to submit a brief (one-to-two page) statement of educational and work experience in applying information technology. All applications are handled centrally through the Office of Graduate Admissions. *Note: the admission process for the graduate certificate is separate from the admission process for a M.S. degree.*

Certificate Requirements

The Certificate requires 12 credit hours of coursework. All requirements must be completed within five years of studies, starting from the time when the first course for the certificate is taken. Coursework taken for one graduate certificate may not be counted towards a second graduate certificate.

Core Course (3 credit hours)

ITIS 6200 Principles of Information Security and Privacy (3)

Elective Courses (9 credit hours)

Select three of the following:

ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5246 - Competitive Cyber Defense (3)
ITIS 5250 - Computer Forensics (3)
ITIS 5260 - Introduction to Security Analytics (3)
ITIS 5331 - Web-Based Mobile and IoT Firmware Security (3)
ITIS 6150 - Software Assurance (3)
ITIS 6167 - Network Security (3)
ITIS 6198 - IT Internship Project (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6240 - Applied Cryptography (3)
ITIS 6260 - Quantum Computing (3)
ITIS 6268 - Wireless Network Security (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6330 - Malware Analysis (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6420 - Usable Security and Privacy (3)

Certificate Total = 12 Credit Hours

Graduate Certificate in Management of Information Technology

The Graduate Certificate in Management of Information Technology provides professionals with an opportunity to advance their level of competence in the management and applications of computing and information technology through formal training. Coursework towards this

graduate certificate can be used for credit towards the M.S. in Information Technology. However, its primary objective is to provide a well-defined target for students who want to advance their knowledge and skills in applying and managing information technology, but do not necessarily wish to complete all the requirements for the M.S. in Information Technology. The certificate may be pursued concurrently with any of the graduate degree programs at UNC Charlotte.

Admission Requirements

This graduate certificate program is open to all applicants who hold a bachelor's degree from a college or university accredited by an accepted accrediting body with a minimum overall GPA of 2.8 and Junior/Senior GPA of 3.0, on a 4.0 scale. In addition, applicants are expected to have substantial working knowledge of applications of information technology.

The requirements on GPA may be waived if an applicant is currently enrolled and in good standing in a graduate degree program at UNC Charlotte.

As part of an application for the graduate certificate program, applicants are required to submit a brief (one-to-two page) statement of educational and work experience in applying information technology. All applications are handled centrally through the Office of Graduate Admissions. *Note: the admission process for the graduate certificate is separate from the admission process for a M.S. degree.*

Certificate Requirements

The Certificate requires 15 credit hours of coursework. All requirements must be completed within five years of studies, starting from the time when the first course for the certificate is taken. Coursework taken for one graduate certificate may not be counted towards a second graduate certificate.

Core Courses (6 credit hours)

ITIS 6342 - Information Technology Project Management (3)
ITIS 6362 - Information Technology: Ethics, Policy, and Security (3)

Elective Courses (9 credit hours)

Select three of the following, at least one of which must be an ITIS course:
ITIS 5166 - Network-Based Application Development (3)*
ITIS 6112 - Software System Design and Implementation (3)*
ITIS 6120 - Applied Databases (3)* -
ITIS 6200 - Principles of Information Security and Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6400 - Human-Centered Design (3)
MBAD 5121 - Business Information Systems (3)
MBAD 6122 - Decision Modeling and Analysis via Spreadsheets (3)
MBAD 6201 - Business Intelligence and Analytics (3)
or DSBA 6201 - Business Intelligence and Analytics (3)
MBAD 6202 - Managing IT-Enabled Business Processes and Systems (3)
MPAD 6160 - Leadership in the Digital Era (3)

**Requires knowledge of data structures and object-oriented programming in C++, C#, or Java.*

Certificate Total = 15 Credit Hours

Graduate Certificate in Network Security

The Graduate Certificate in Network Security provides professionals with an opportunity to advance their knowledge and skills in cybersecurity for networked systems. The certificate requires fifteen (15) graduate credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

This graduate certificate program is open to all applicants who hold a bachelor's degree from a college or university accredited by an accepted accrediting body in a computing, mathematical, engineering or business discipline, with a minimum overall GPA of 2.8 and Junior/Senior GPA of 3.0, on a 4.0 scale. In addition, applicants are required to have substantial knowledge of data structures and object-oriented programming in C++, C# or Java.

The requirements on GPA may be waived if an applicant is currently enrolled and in good standing in a graduate degree program at UNC Charlotte.

Certificate Requirements

The graduate certificate must meet both the University-wide graduate certificate requirements as specified in the *Graduate Catalog* and the certificate specific requirements of 15 credit hours of coursework. All requirements must be completed within five years of studies, starting from the time when the first course for the certificate is taken. Coursework taken for one graduate certificate may not be counted towards a second graduate certificate.

Core Courses (12 credit hours)

ITIS 5250 - Computer Forensics (3)
ITIS 6167 - Network Security (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITCS 6166 - Computer Communications and Networks (3)

Elective Course (3 credit hours)
Select one of the following:
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 5246 - Competitive Cyber Defense (3)
ITIS 5260 - Introduction to Security Analytics (3)
ITIS 6150 - Software Assurance (3)
ITIS 6200 - Information Security and Privacy (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6240 - Applied Cryptography (3)
ITIS 6268 - Wireless Network Security (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security (3)
ITIS 6420 - Usable Security and Privacy (3)

Certificate Total = 15 Credit Hours

Graduate Certificate in Secure Software Development

The Graduate Certificate in Secure Software Development provides professionals with an opportunity to advance their knowledge and skills in developing software applications that are secure. The certificate requires 15 graduate credit-hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

This graduate certificate program is open to all applicants who hold a bachelor's degree from a college or university accredited by an accepted accrediting body in a computing, mathematical, engineering or business discipline, with a minimum overall GPA of 2.8 and Junior/Senior GPA of 3.0, on a 4.0 scale. In addition, applicants are required to have substantial knowledge of data structures and object-oriented programming in C++, C# or Java.

The requirements on GPA may be waived if an applicant is currently enrolled and in good standing in a graduate degree program at UNC Charlotte.

Certificate Requirements

The graduate certificate must meet both the University-wide graduate certificate requirements as specified in the *Graduate Catalog* and the certificate specific requirements of 15 credit hours of coursework. All requirements must be completed within five years of studies, starting from the time when the first course for the\ certificate is taken. Coursework taken for one graduate certificate may not be counted towards a second graduate certificate.

Core Courses (9 credit hours)
ITIS 5221 - Secure Programming and Penetration Testing (3)
ITIS 6150 - Software Assurance (3)
ITIS 6420 - Usable Security and Privacy (3)

Elective Courses (6 credit hours)
Select two of the following:
ITIS 5166 - Network Based Application Development (3)
ITIS 5180 - Mobile Application Development (3)
ITIS 5250 - Computer Forensics (3)
ITIS 6112 - Software System Design and Implementation (3)
ITIS 6167 - Network Security (3)
ITIS 6200 - Information Security and Privacy (3)
ITIS 6210 - Access Control and Security Architecture (3)
ITIS 6220 - Data Privacy (3)
ITIS 6230 - Enterprise and Infrastructure Protection (3)
ITIS 6240 - Applied Cryptography (3)
ITIS 6260 - Quantum Computing (3)
ITIS 6320 - Cloud Data Storage (3)
ITIS 6342 - Information Technology Project Management (3)
ITIS 6362 - Information Technology Ethics, Policy, and Security
ITCS 6114 - Algorithm and Data Structures (3)

Certificate Total = 15 Credit Hours

Graduate Certificate in Software Development

The Graduate Certificate in Software Development is designed for students who do not have an undergraduate degree related to computing or for students who completed a computing degree many years ago. The certificate covers foundational computer science topics that would prepare a student for a position as a software developer or for completing a master's degree in computer-related disciplines. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte. Courses taken in this graduate certificate can be applied toward the M.S. in Information Technology degree.

Admission Requirements

Applicants must meet the general Graduate School requirements for admission to Graduate Certificate programs. Applications must include all of the materials listed by the Graduate School as typical for Graduate Certificate application submissions.

Certificate Requirements

Required Courses (15 credit hours)
This graduate certificate is comprised of 5 required courses. Students should start with ITIS 5101 to gain experience in programming. ITIS 5135 can be taken

concurrently with ITIS 5101. Both should be taken prior to the remaining 3 courses in the certificate.

ITIS 5101 - Foundations of Programming (3)
ITIS 5135 - Web-Based Application Design and Development (3)
ITIS 5166 - Network-Based Application Development (3)
ITIS 6112 - Software System Design and Implementation (3)
ITIS 6120 - Applied Databases (3)

Certificate Total = 15 Credit Hours

Grade Requirements

Students must achieve a 3.0 GPA to complete the certificate. No more than one grade of C may count towards the certificate.

Cato College of Education

education.charlotte.edu

At the University of North Carolina at Charlotte, graduate students in the Cato College of Education have many different opportunities to expand their knowledge and skills in preparation for new educational roles and increased leadership responsibilities. While many professional education programs lead to advanced NC licensure, other programs lead to both initial and advanced licensure, and still others are not associated with licensure. The Cato College of Education is accredited by the Council for the Accreditation of Educator Preparation (CAEP), and the Counseling programs are accredited by the Council on Accreditation of Counseling and Related Programs (CACREP). All licensure programs are approved by the North Carolina State Board of Education. Program graduates positively influence their peers, clients, and students; contribute to the development of effective schools and agencies for all children; and work to alleviate and prevent many of today's educational and social obstacles. The curricula of most of the Cato College of Education's teacher education programs align with the core propositions, skill sets, academic language, and concepts from the National Board of Professional Teaching Standards (NBPTS).

One of the college's most important functions is to serve as a regional resource in education, research, and service to help address the challenges of urban schools. The college has a strong partnership with the 12 school districts in the Southwest Education Alliance and is located within the bounds of Charlotte-Mecklenburg Schools (CMS), a large urban district.

Doctoral Programs

- **Doctor of Education (Ed.D.)**
  - Educational Leadership
- **Doctor of Philosophy (Ph.D.)**
  - Counselor Education and Supervision
  - Curriculum and Instruction
  - Educational Research, Measurement, and Evaluation
  - Special Education

Master's Degree Programs

- **Master of Arts (M.A.)**
  - Counseling
  - English Education *(Advanced licensure; see under English in the College of Liberal Arts & Sciences section)*
- **Master of Arts in Teacher Education (M.A.T.)**

  Combines Initial and Advanced licensure
  - Career and Technical Education (6-12)
  - Child and Family Studies: Early Education (Birth-Kindergarten)
  - Elementary Education (K-6)
  - Foreign Language Education (K-12)
  - Middle Grades Education (6-9)

- Secondary Education (9-12)
- Special Education (K-12)
- Teaching English as a Second Language (K-12)

Master of Education (M.Ed.)

Advanced licensure

- Child and Family Studies: Early Education (Birth-Kindergarten)
- Curriculum and Instruction (6-9, 9-12, K-12) *(Also offers a non-licensure concentration)*
- Elementary Education (K-6)
- Learning, Design, and Technology (K-12) *(Also offers a non-licensure concentration)*
- Reading Education (K-12)
- Special Education and Child Development (K-12)

Non-licensure

- Educational Leadership (Higher Education)
- Urban Education

Master of School Administration (M.S.A.)

Advanced licensure

- School Administration (K-12)

Master of Science (M.S.)

- Mathematics Education *(Advanced licensure; see under Mathematics and Statistics in the College of Liberal Arts & Sciences section)*

Graduate Non-Degree Programs

Graduate Certificates

- Advanced Literacy Instruction and Intervention
- Anti-Racism
- Autism Spectrum Disorder
- Early Childhood Mental Health *(in collaboration with College of Health and Human Services)*
- Instructional Coaching
- National Board Certification
- Play Therapy
- Quantitative Analyses

Graduate Certificates

Leading to Initial Teacher Licensure (ideal for individuals who have a bachelor's degree in another area and are interested in a career in education)

- Career and Technical Education (business, marketing, technology, family, and consumer science)**
- Child and Family Development (Birth through Kindergarten)
- Elementary Education (K-6)
- Fine and Performing Arts Education: Art (K-12) *(in collaboration with College of Arts + Architecture)*
- Foreign Language Education (K-12)*
- Middle Grades Education (6-9)
- Secondary Education (9-12)
- Special Education (K-12)
- Teaching English as a Second Language (K-12)

** Due to limited availability of internship sites, candidates seeking licensure in certain languages must be residency teachers and complete the internship in their own classrooms.*

*** The Career and Technical Education license spans grades 6-12 and is a concentration of the Graduate Certificate in Middle and Secondary Education.*

Graduate Certificates

Leading to Add-On Licensure (ideal for individuals who have a teaching license and bachelor's degree and would like to add an area to their current teaching license)

- Elementary Mathematics Education (K-6)
- Special Education: Academic or Intellectually Gifted (K-12)
- Learning, Design, and Technology (K-12)***

**** Individuals do not have to have a teaching license in order to pursue this graduate certificate, but if they do, they can receive the 079 special endorsement.*

Post-Master's Certificate Programs

- Addiction Counseling
- School Administration
- School Counseling
- University and College Teaching

CHILD AND FAMILY STUDIES

- Master of Education (M.Ed.) in Child and Family Studies: Early Education
- Master of Education (M.Ed.) in Special Education and Child Development *(see the Special Education section)*
- Master of Arts in Teaching (M.A.T.) in Child and Family Studies: Early Childhood Education (Birth-Kindergarten)
- Graduate Certificate in Child and Family Development: Birth through Kindergarten
- Graduate Certificate in Early Childhood Mental Health

Department of Special Education and Child Development
spcd.charlotte.edu

M.Ed. in Child and Family Studies: Early Education

The Master of Education (M.Ed.) in Child and Family Studies: Early Education program is for individuals with a bachelor's degree in Child and Family Development, Elementary Education, Special Education, or a related field.

The M.Ed.) in Child and Family Studies: Early Education prepares professionals for leadership positions that serve young children with and without disabilities and their families. It is conveniently designed for prospective students who wish to pursue an advanced degree on a part-time basis. The graduate degree program is for professionals who teach or provide services or intervention in infant, toddler, preschool, and kindergarten settings that include young children with and without disabilities; who administer family agency programs that have a child development and family relations focus; who work as consultants, parent educators, inclusion specialists, program coordinators, supervisors, and staff development trainers; who wish to pursue certification as a Child Life Specialist (through the Child Life Council); or who seek research and evaluation expertise in child and family studies and community leadership in child and family programs. Graduates who possess an initial license in Birth-Kindergarten at the time of application and acceptance will qualify for the North Carolina Standard Professional 2 (SP2) Professional Educator's License in Birth-Kindergarten (B-K) issued by the North Carolina Department of Public Instruction upon completion of the program.

Admission Requirements

1) A bachelor's degree in Child and Family Development, Elementary Education, Special Education, or a related field from a college or university accredited by an accepted accrediting body
2) Official transcripts of all previous work beyond high school documenting an overall GPA of at least 3.0 (based on a 4.0 scale)
3) Evidence of satisfactory scores on the Graduate Record Examination (GRE) or the Miller Analogies Test (MAT)
4) A personal statement outlining why the applicant seeks admission to the program and describing professional experiences with young children and their families
5) Three letters of recommendation from persons familiar with the applicant's personal or professional qualifications
6) Apply online at gradadmissions.charlotte.edu

Degree Requirements

The M.Ed. in Child and Family Studies: Early Education requires a total of 33 credit hours of coursework.

Child and Family Studies Core Courses (15 credit hours)
CHFD 6102 - Learning and Development (3)
CHFD 6115 - Child and Family Advocacy (3)
CHFD 6210 - Inclusive Education for Young Children (3)
CHFD 6220 - Family Theory and Research (3)
CHFD 6240 - Advanced Studies in Infant and Child Development (3)

Applied Research/Evaluation Courses (6 credit hours)
RSCH 6101 - Research Methods (3)
CHFD 6900 - Research in Child and Family Studies (3)

Thematic Elective Courses (9 credit hours)
Selected from the following categories: Learning, Design, and Technology; Teaching English as a Second Language; Leadership and Administration; Reading, Language, and Literacy; Research Methods; Early Intervention/Early Childhood Special Education; Child Life; or an individually planned option, with advisor approval.

Leadership Seminar (3 credit hours)
CHFD 7400 - Applied Leadership in Child and Family Studies (3)

Degree Total = 33 Credit Hours

Clinical Field Experiences
Most courses require students to apply the knowledge learned in classes to community-based settings.

Master's Project/Thesis
The nature of the project/thesis is developed by the student in consultation with the major professor and presented to the Advisory Committee for approval. The project is usually something that is practical and useful to the student in the professional role that will be assumed upon the completion of the degree. The thesis takes a more research-oriented approach.

Elective Courses
The M.Ed. in Child and Family Studies: Early Education includes 9 elective credit hours which are determined in consultation with the student's academic advisor.

Advising
Upon admission, each student is assigned a faculty advisor who helps the student develop his or her program of study and must approve that program of study. Each student must also assemble a graduate committee for consultation and evaluation. Members of the committee include the student's faculty advisor and at least two other faculty members who represent major areas of concentration in the student's program.

Licensure
Successful completion leads to the North Carolina Standard Professional 2 (SP2) Professional Educator's License in Birth-Kindergarten (B-K).

Committees
Students should consult with their academic program advisor in the selection of the committee. The following guidelines are intended to assist the student and his or her academic program advisor in constituting the master's committee.

1) Chair - selected for content knowledge of the subject area that is selected for the culminating experience. This person should be from the major department. In addition, the chair must hold a graduate faculty appointment in the department.
2) Second and third members - selected for knowledge and expertise in the subject area (can be external to the department).
3) Technical advisor – an optional committee member selected for technical support (e.g., specialized skills in program evaluation, technical writing, assessment, curriculum design, graphics, ethnography, and survey research methodology). This person may be, but need not be, from the department.
4) Additional members - may be added if the committee chair agrees. These members may be from departments of the College other than the student's department, and may be from other colleges in the University. Additional members may also be from outside the University with the prior written permission of the Dean of the Graduate School. (This whole process should start at the beginning of the semester prior to graduation. However, the student may begin anytime after completing 18 hours.)

Research Opportunities/Experiences
The Child and Family Development faculty provide students with the opportunity to become involved in a variety of research endeavors. Each student will complete a research thesis.

M.A.T. in Child and Family Studies: Early Childhood Education (Birth-Kindergarten)

The Master of Arts in Teaching (M.A.T.) program is designed for individuals who have completed the Graduate Certificate in Child and Family Development: Birth through Kindergarten. The M.A.T. program is a 35 credit hour program comprised of two phases, the Graduate Certificate phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I of the M.A.T. leads to the North Carolina Standard Professional 1 (SP1) Professional Educator's License in Birth-Kindergarten. Phase I requires 21 credit hours of coursework, including the graduate internship experience. Upon completion of Phase I, qualified candidates may apply for Phase II to work towards the Master's degree and qualify for the North Carolina Standard Professional 2 (SP2) Professional Educator's License.

All courses for both phases of the M.A.T. must be completed within seven years. Coursework within Phase I/Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School
Please refer to admission information in the "Graduate School" section of this *Catalog*.

Admission Requirements
Graduate Certificate in Teaching (M.A.T. Phase I Initial licensure only)

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 3.0. *(For alternative ways to demonstrate academic*

competence, applicants may contact the Office of Teacher Education Advising and Licensure (TEAL))

3) Three recommendations from persons knowledgeable of the applicant's interaction with children and families
4) A statement of purpose
5) A clear criminal background check
6) Apply online at gradadmissions.charlotte.edu

M.A.T. (Phase II) Program

1) Completion of the Graduate Certificate in Teaching
2) A minimum graduate GPA of 3.5 in the Graduate Certificate in Teaching*
3) One recommendation from a full-time faculty member who has taught the applicant in the Graduate Certificate in Teaching program
4) A statement of purpose
5) Apply online at gradadmissions.charlotte.edu

**Students with a GPA below 3.5 in the Graduate Certificate in Teaching may be considered for admission to the M.A.T. program with scores above the 30th percentile on either the Graduate Record Exam or Miller Analogies Test.*

Degree Requirements

Phase I/ Graduate Certificate Required Courses (21 credit hours)

CHFD 5100 - Development: Prenatal to Pre-Adolescence (3)
CHFD 5250 - Assessment of Young Children (3)
CHFD 6110 - Family-Professional Partnerships (3)
CHFD 6200 - Curriculum and Learning Environments for Young Children (3)
CHFD 6230 - Emerging Literacy and Mathematical Understanding (3)
CHFD 6400 - Student Teaching Seminar: B-K Child and Family Development (6)

Phase II/ Completion of the M.A.T. Required Courses (14 credit hours)

RSCH 6101 - Research Methods (3)
CHFD 6300 - Evidence-Based Practices in Child and Family Studies (3)
CHFD 6330 - Action Research Development and Proposal (3)
CHFD 7600 - Leadership in Child and Family Studies (3)
CHFD 7691 - Project Implementation in Child and Family Studies (2)

Degree Total = 35 Credit Hours

Capstone Experiences

The capstone experience for the M.A.T. will be fulfilled by completing the action research project.

Advising

Upon acceptance into the program, all students are assigned an advisor. Students are expected to meet with their advisor each semester to discuss their coursework.

Licensure

Upon successful completion of the M.A.T. Phase I/Graduate Certificate, students are recommended for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. For this initial license, students are required to complete an electronic licensure portfolio that is created during coursework and the internship. Upon successful completion of the M.A.T. Phase II, students are recommended for the North Carolina Standard Professional 2 (SP2) Professional Educator's License. For the Professional 2 license, students are required to complete an advanced electronic licensure portfolio during coursework.

Committees

Students should consult with their academic program advisor in the selection of the committee. The committee chair should be selected for content knowledge of the subject area that is selected for the culminating experience. This person should hold a graduate faculty appointment in the CHFD program. Two additional committee members should be selected for knowledge and expertise in the student's subject area. One of the additional members may be external to the student's department.

Graduate Certificate in Child and Family Development: Birth Through Kindergarten

The Graduate Certificate in Child and Family Development: Birth through Kindergarten is a 21 credit hour program that prepares professionals for careers that serve young children with and without disabilities and their families. It is designed for prospective students already working in professional settings who wish to pursue a North Carolina Standard Professional 1 (SP1) Professional Educator's License in Birth-Kindergarten (B-K) on a part-time basis.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to admission information in the "Graduate School" section of this *Catalog*.

Admission Requirements for Graduate Certificate in Teaching Programs

1) An undergraduate degree in a related field* from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75*
3) Three recommendations from persons knowledgeable of the applicant's interaction with children and families
4) A statement of purpose
5) A clear criminal background check
6) Apply online at gradadmissions.charlotte.edu

**For alternative ways to demonstrate academic competence, applicants may contact the Office of Teacher Education Advising and Licensure (TEAL)*

Certificate Requirements

The NC State Board of Education requires that B-K candidates demonstrate content mastery with 24 relevant credit hours. Due to the 18 credit hour curriculum of this certificate, students who do not have 6 relevant credit hours at the time of admission will be required to complete those hours in addition to the standard program of study prior to student teaching. Contact the Office of Teacher Education Advising and Licensure for assistance with determining relevant credit hours.

CHFD 5100 - Development: Prenatal to Pre-Adolescence (3)
CHFD 5250 - Assessment of Young Children (3)
CHFD 6110 - Family-Professional Partnerships (3)
CHFD 6200 - Curriculum and Learning Environments for Young Children (3)
CHFD 6230 - Emerging Literacy and Mathematical Understanding (3)
CHFD 6400 - Student Teaching Seminar: B-K Child and Family Development (6)

Internship

A 3 credit hour internship is required for Graduate Certificate students. The graduate-level internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. Students are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and university faculty. This internship may be completed in a candidate's employment site which meets placement criteria or the University can find a placement for the student. Lateral entry teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the internship experience and licensure requirements. This contact should take place at least one semester before the internship.

Certificate Total = 21 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisor at least once each semester.

Application for Degree

The Application for Degree/Graduation form supplied by the Graduate School must be received early in the last semester of the student's program.

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in community-based settings. *All students are expected to complete clinical experiences in at least two significantly different settings.* Candidates who are residency teachers and teacher assistants must move beyond their own classrooms, and employed candidates are encouraged to seek assistance and support from their administrators.

Licensure

Upon successful completion of the Graduate Certificate, candidates are recommended for the North Carolina Initial Professional Educator's License. For this license, students are required to complete an electronic licensure portfolio that is created during coursework and the internship. Students apply for the North Carolina Initial Professional Educator's License in the TEAL Office.

Beginning Fall 2019, all candidates must meet the minimal cut score requirement on edTPA and meet all other student teaching requirements in order to receive a licensure recommendation. For details, see edassessment.charlotte.edu/edtpa-information.

Graduate Certificate in Early Childhood Mental Health

The Graduate Certificate in Early Childhood Mental Health (ECMH) program is sponsored jointly by UNC Charlotte's School of Social Work and Department of Special Education and Child Development. It is an interdisciplinary post-baccalaureate certificate program that addresses the increasing need for mental health services for children from birth to five years of age. There is growing interest in infant and early childhood mental health; however, young children are rarely the focus of graduate training programs. Whereas mental health work with older children emphasizes increased personal choice-making and negotiation skills, mental health work with younger children is focused on the quality of the child's

relationships, resources, and social environment. Consequently, parents and other caretakers are a much more integral part of prevention and intervention efforts for young children. Graduates of the EMCH certificate program will be able to:

- Promote awareness about the importance of early childhood mental health
- Work with diverse families with young children
- Identify evidence-informed services for young children and their families
- Recognize, refer, and perform ecologically valid mental health assessments of young children
- Explain the relationships between social, cognitive, and communication development in young children
- Support positive, relationship-focused communication between young children and their caretakers
- Facilitate positive social-communication skills between young children and their caretakers in a variety of settings

General Requirements for Admission to the Graduate School

Please refer to admission information in the "Graduate School" section of this *Catalog*.

Graduate Certificate Program Admission Requirements

The ECMH certificate program welcomes professionals with a completed undergraduate or graduate degree in a human services field, including: counseling, education, early childhood special education, pediatrics, allied health services (i.e., occupational therapy, physical therapy, speech-language pathology), psychology, and social work. Individuals who are currently enrolled in a human service-related graduate degree program at UNC Charlotte are also welcome to apply to the ECMH certificate program.

Admission to the Graduate Certificate in ECMH requires the following:

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendation letters from persons knowledgeable of your interaction with children or youth *(Applicants to the ECMH certificate program who are already enrolled in a graduate degree program in the School of Social Work or Department of Special Education and Child Development are not required to submit letters of recommendation)*
4) Statement of purpose
5) Clear criminal background check
6) Apply online at graduateschool.charlotte.edu

Students interested only in the Graduate Certificate in ECMH are not required to take the GRE or MAT. Certificate students who later wish to apply to the M.S.W. or M.Ed. programs must follow all admissions requirements for those programs, including entrance examinations. Successful completion of courses in the ECMH certificate program does not guarantee admission to any other UNC Charlotte graduate program. If a certificate-only student would like to apply for admission to either the M.S.W. or M.Ed. program, the student must complete an additional graduate application. Students can begin the ECMH certificate program during any semester.

If an ECMH Graduate Certificate student is accepted into a master's degree program, courses completed in the Graduate Certificate program may be applied toward the Master of Social Work program or the M.Ed. in Child and Family Studies program at the discretion of the Graduate Program Director of the program to which the student applies and in compliance with existing University policy. However, credits earned in one certificate program may not be used to satisfy the requirements of a second certificate program. Additionally, all courses for the master's degree must be completed within seven years of initial enrollment. All courses for the Graduate Certificate in ECMH only must be completed within five years from initial enrollment in the certificate program.

Certificate Requirements

The certificate program requires a minimum of 12 graduate credit hours. Courses are offered asynchronously (no class meetings) and are fully online. Courses required for the ECMH certificate program can be taken in any order.

Required Courses (12 credit hours)

CHFD 6240 - Advanced Studies in Infant and Child Development (3)
SOWK 6171 - Early Childhood Mental Health (3)
SPED 6242 - Enhancing Communication and Supporting Behaviors in Inclusive Settings: B-K (3)
SPED 6350 - Young Children with Disabilities and their Families: Interdisciplinary Collaboration (3)

Note: Course prerequisites and corequisites for CHFD 6240 and SPED 6242 are waived for students completing only the Graduate Certificate in Early Childhood Mental Health. Permission of the Graduate Program Director is required for enrollment in courses with prerequisites.

Certificate Total = 12 Credit Hours

COUNSELING

- Ph.D. in Counselor Education and Supervision
  - Play Therapy
- M.A. in Counseling
  - Addiction
  - Clinical Mental Health
  - Play Therapy
  - School Counseling
- Post-Master's Certificate in Addiction Counseling
- Graduate Certificate in Play Therapy
- Post-Master's Certificate in School Counseling

Department of Counseling
counseling.charlotte.edu

Ph.D. in Counselor Education and Supervision

The Ph.D. in Counselor Education and Supervision is designed to provide doctoral-level preparation for professionals who seek higher education positions in counselor preparation programs and advanced clinical training and leadership positions in the counseling field. A unique feature of this program is its emphasis on increasing knowledge, awareness, and skills in interacting with socially and culturally diverse populations. The program addresses professional roles in five doctoral core areas: (1) counseling, (2) supervision, (3) teaching, (4) research and scholarship, and (4) leadership and advocacy. These five doctoral core areas represent the foundational knowledge required of doctoral graduates in counselor education. Doctoral-level students in counselor education may work as counselor educators, counselor supervisors, direct service providers, program consultants, researchers, program evaluators, and in other roles that require leadership in the areas of counseling, human services, family development, and community organizations. Potential employment settings include institutions of higher education, schools, hospitals, employee assistance programs, substance abuse treatment centers, community mental health agencies, and private practice centers.

The Ph.D. in Counselor Education and Supervision requires a minimum of 63 credit hours beyond those earned in an accredited master's program of at least 48 credit hours. Advance preparation is required in the following areas:

1) Implications of ways in which diversity (e.g., race, gender, age, religion, spirituality, ethnicity, mental/physical ability, nationality, and sexual orientation) influence counseling practice and counselor education
2) Theories pertaining to the principles and practice of counseling, career development, group work, and consultation
3) Clinical skill development in counseling, group work, and consultation
4) Theories and practice of counselor supervision
5) Design and implementation of quantitative research and methodology
6) Design and implementation of qualitative research and methodology
7) Models and methods of assessment and use of data
8) Ethical and legal considerations in counselor education and supervision
9) Instructional theory and methods relevant to counselor education

In addition to a 100-hour clinically based doctoral practicum, doctoral students participate in internship experiences of at least 600 clock hours that include teaching, supervision, and research.

Students also collaborate with faculty as a part of their Professional Development Plan in teaching, supervision, counseling services, research, professional writing, and service to the community, region, and profession.

Program Objectives
1) To acquire, integrate, and apply empirical and theoretical knowledge of the field of counseling
2) To develop leadership and advocacy skills in counselor education, supervision, advanced counseling practice, and research
3) To apply advanced skills and competencies in field-based settings
4) To conduct research and generate new knowledge in counseling
5) To design, adapt, and evaluate curricula in the field of counseling
6) To develop depth and breadth in professional growth and continued life-long learning
7) To examine the influence of social context and policy variables on human behavior
8) To show increased sensitivity and clinical skills that demonstrate awareness of the diversity of race, gender, age, religion, ethnicity, mental/physical ability, nationality, and sexual orientation as relevant to counseling professionals

Admission Requirements
Applicants should possess a CACREP-approved Master's Degree in counseling with a cumulative GPA of 3.5 (on a scale of 4.0) or higher. Students with master's degrees

requiring less than 60 credit hours or degrees from non-CACREP-approved Master's programs may need to complete prerequisite courses. All doctoral students accepted into the program who graduated from a CACREP accredited program prior to 2009 or who graduated from a non-CACREP accredited program must provide documentation of a graduate level substance abuse/addiction course or add a substance abuse/addiction course to their program of study. At least one year of experience as a professional counselor is preferred.

Degree Requirements

The Ph.D. in Counselor Education and Supervision requires 63 credit hours of coursework, including the dissertation. If students add the optional Concentration in Play Therapy, their program becomes 69 credit hours.

Core Courses (21 credit hours)
CSLG 8100 - Advanced Theories of Counseling (3)
CSLG 8105 - Introduction to Counselor Education and Supervision (3)
CSLG 8110 - Clinical Supervision in Counseling (3)
CSLG 8203 - Instructional Theory in Counselor Education (3)
CSLG 8345 - Advanced Multicultural Counseling (3)
CSLG 8346 - Applied Multicultural Counseling (3)
CSLG 8998 - Seminar in Prospectus Design (3)

Clinical Courses (12 credit hours)
CSLG 8431 - Doctoral Practicum in Counseling (3)
CSLG 8440 - Doctoral Internship: Counseling (3)
CSLG 8442 - Doctoral Internship: Supervision (3)
CSLG 8445 - Doctoral Internship: Teaching (3)

Research Courses (24 credit hours)
RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8111 - Qualitative Research Methods (3)
RSCH 8120 - Advanced Statistics (3)
RSCH 8140 - Multivariate Statistics (3)
RSCH 8210 - Applied Research Methods (3)
CSLG 8999 - Dissertation (1-9) (minimum of 9 credit hours)

Elective Courses (6 credit hours)
Select a minimum of two of the following:
CSLG 7000-8999 - Counseling Elective (3)
RSCH 7000-8999 - Research Elective (3)

Notes:

- *Courses outside the above list must have approval of the student's Doctoral Advisory Committee and an Academic Petition must be submitted requesting the change.*
- *GRAD 8990, required for all doctoral students, is satisfied by RSCH 8210.*

Play Therapy Concentration *(Optional)* (12 credit hours)
Concentration Required Courses (9 credit hours)
CSLG 7142 - Introduction to Play Therapy (3)

Plus two of the following:
CSLG 7143 - Filial Therapy: An Approach to Parent Training (3)
CSLG 7144 - Contemporary Theories of Play Therapy (3)
CSLG 7147 - Multicultural and Social Justice Issues in Play Therapy (3)

Concentration Elective Course (3 credit hours)
Select one of the following:
CSLG 7145 - Special Topics in Play Therapy (3)
Remaining course not taken above (CSLG 7143, CSLG 7144, or CSLG 7147)
Other course approved by the Director of the Play Therapy concentration

Degree Total = 63 Credit Hours

Admission to Candidacy

Students are considered candidates for the doctoral degree on successful completion of the Comprehensive Examination and acceptance of the Dissertation Proposal.

Advising

Students select a program advisor and committee by the end of their first fall semester in the program. The program advisors assist students during the initial stages of the program, which includes developing a Program of Study aligned with the program plan in DegreeWorks for the catalog year in which the student entered the program, developing a Professional Development Plan, and identifying faculty whose research interests and expertise are congruent with students' areas of inquiry for the dissertation. The assistance of the advisor does not relieve students of responsibility for following departmental and University procedures. Following the comprehensive exam, students select a dissertation advisor/chair and committee. The program advisors continue to provide academic advisement to students through their program, regardless of whether they are part of students' dissertation committee.

Comprehensive Exam

The main objective of the written portion of the qualifying exam is to ensure that the student is adequately prepared to write a dissertation to complete the Ph.D. degree requirements. Being prepared means the following:

1) Examinees must have completed all degree core content courses.
2) Examinees must be able to analyze and synthesize information obtained from coursework and research within a multicultural counseling context.

3) Examinees must demonstrate advanced knowledge in the core areas of counselor education.
4) Examinees must demonstrate competencies in research methodology and evaluation.

The comprehensive exam is a 2-day written exam administered on campus.

Dissertation

Each candidate for the doctoral degree is required to prepare and present a dissertation that shows independent investigation and is acceptable in form and content to the Dissertation Committee. A doctoral dissertation must demonstrate the candidate's ability to conceive, design, conduct, and interpret independent, original, and creative research and must make a unique contribution to knowledge in the field of counseling. Under the direct supervision of the Doctoral Committee Chair, students are encouraged to consult regularly with their Dissertation Committee members during the planning, conducting and writing of the dissertation. Following the approval of the dissertation proposal students are required to maintain continuous enrollment (fall and spring semesters) for dissertation study until work is completed. Continuous enrollment begins on the date the Graduate School approves the student's dissertation topic. Students who exceed the required number of dissertation hours for degree completion will register for GRAD 9999 each semester until degree requirements have been completed.

Dissertation Committee

A Dissertation Committee, comprised of at least five faculty members, will be formally appointed for each student after admission to candidacy. At least three committee members must be on the Counseling Program faculty and one member will be appointed by the Graduate School. A person outside the University may serve as a full member of the Dissertation Committee in situations where knowledge or expertise of a particular nature is desired. With the mutual consent of the student and the faculty member, a faculty member will be designated to serve as the Chair of the Doctoral Committee. Chairs of Doctoral Committees are specifically responsible for seeing that the student progresses in an expeditious manner towards completion of the degree. Chairs will assist students in organizing committee meetings, conducting original research, presenting the proposal, and organizing the dissertation defense. Eligible faculty are all tenured faculty (Professor/Associate Professor), as well as Assistant Professors who have been reappointed for their second term. Each appointed Committee Member will have both voice and vote on all relevant matters pertaining to a doctoral student's progress towards the degree. At least four committee members must be present for the oral defense of the dissertation. The oral defense is considered satisfactory upon the positive vote of at least four committee members. Prior to and following the appointment of this committee, students are encouraged to work with faculty on dissertation ideas.

Internships

Doctoral students are required to complete a total of 600 clock hours of internship in the areas of teaching, supervision, and research. Students and their doctoral advisors develop collaboratively components of their internship experiences in accordance with relevant CACREP standards.

Practicum

A Doctoral Practicum is taken in the first year of study. The practicum requires 100 hours over the course of a semester at an approved site in the community. The Practicum involves the acquisition of new skills and learning regardless of the site selected.

M.A. in Counseling

The Master of Arts in Counseling offers concentrations in School Counseling, Clinical Mental Health Counseling, and Addiction Counseling. In addition, the program offers an additional secondary Play Therapy concentration.

All concentrations qualify graduates to become a Licensed Professional Counselor Associate (LPCA) in the state of North Carolina. Graduates can also apply for credentialing as an Nationally Certified Counselor (NCC) through the National Board of Certified Counselors.

The School Counseling concentration qualifies graduates for advanced-level K-12 school counseling licensure in North Carolina. Those completing the Addiction concentration can apply to become certificated as a Licensed Clinical Addiction Specialist (LCAS) through the NC Substance Abuse Professional Practice Board. The Play Therapy concentration meets the educational requirements, as specified by the Association for Play Therapy (APT), for the Registered Play Therapist (RPT) credential, is recognition of academic achievement, and enhances professional standing.

Program Objectives

As prospective professional counselors, graduates of the program are prepared to: counsel clients, both individually and in groups, on educational, career, life planning, social, emotional, physical, spiritual, and organizational concerns; provide information to clients for educational, social, career, and/or life planning; consult with other professionals concerning client needs; and conduct needs assessments, evaluations, and other activities for program design.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the criteria for admission to the M.A. in Counseling program include an applicant's potential success in forming effective interpersonal relationships in individual and small-group contexts; aptitude for graduate-level study; career goals and objectives; openness to self-examination; and potential for personal and professional self-development. Students are not required to have an undergraduate major in any particular field to enter the counseling program. Admission decisions are based on applicants' individual profiles and made by a committee of program faculty. Applicants with the highest profile rankings are invited to campus for an interview process; the number invited is determined by the number of anticipated openings in the program. Students are admitted to the program in the Spring of each year, and they are expected to begin their studies the following Summer or Fall semester. The application deadline for each year's admissions process is December 1.

Degree Requirements

The M.A. in Counseling program requires a total of 60 credit hours, including core courses for all students and specialization courses for students in School Counseling, Clinical Mental Health Counseling, or Addiction. In addition, the programs offers an additional secondary Play Therapy concentration. Each concentration includes a series of required courses, clinical experience courses, and elective courses.

Core Courses for All Students (30 credit hours)

CSLG 6100 - Counseling Theories (3)
CSLG 6101 - Ethical and Professional Issues in Counseling (3)
CSLG 6104 - Counseling Across the Lifespan (3)
CSLG 6110 - Counseling Techniques (3)
CSLG 6111 - Advanced Counseling Techniques (3)
CSLG 6120 - Group Counseling (3)
CSLG 6145 - Multicultural and Social Justice Counseling (3)
CSLG 6150 - Career Development and Counseling (3)
RSCH 6101 - Research Methods (3)
RSCH 6109 - Assessment and Evaluation Methods (3)

Concentrations (30 credit hours)

Addiction Concentration

Addiction Courses (18 credit hours)
CSLG 6160 - Theories of Addiction (3)
CLSG 6161 - Assessment and Diagnosis of Addictive Disorders (3)
CSLG 6162 - Inventions in Addiction Counseling (3)
CSLG 6163 - Treatment Planning and Relapse Prevention in Addiction Counseling (3)
or CSLG 6164 - The McLeod Institute on Addiction (3)

Clinical Experiences (Addiction Setting) (9 credit hours)
CSLG 7430 - Practicum in Counseling (3) (150 hours)
CSLG 7435 - Internship in Counseling (3) (300 hours) *(taken twice)*

Elective Course (3 credit hours)
The elective course must be approved by the student's advisor.

Clinical Mental Health Concentration

Clinical Mental Health Courses (9 credit hours)
CSLG 7170 - Introduction to Clinical Mental Health Counseling (3)
CSLG 6153 - Diagnosis and Treatment in Counseling (3)

Plus one Addiction course from the following:
CSLG 6000 - Topics in Counseling (1 to 6) *(McLeod Institute)*
CSLG 6160 - Theories of Addiction (3)
CLSG 6161 - Assessment and Diagnosis of Addictive Disorders (3)
CSLG 6162 - Inventions in Addiction Counseling (3)
CSLG 6163 - Treatment Planning and Relapse Prevention in Addiction Counseling (3)
CSLG 6164 - The McLeod Institute on Addiction (3)

Clinical Experiences (Clinical Mental Health Setting) (9 credit hours)
CSLG 7430 - Practicum in Counseling (3) (150 hours)
CSLG 7435 - Internship in Counseling (3) (300 hours) *(taken twice)*

Elective Courses (12 credit hours)
These courses must be approved by the student's advisor.

School Counseling Concentration

School Counseling Courses (9 credit hours)
CSLG 7140 - Consultation in School Counseling (3)
CSLG 7141 - The Professional School Counselor (3)
CSLG 7646 - Advocacy and Leadership in Professional School Counseling (3)

Clinical Experiences (School Setting) (9 credit hours)
CSLG 7430 - Practicum in Counseling (3) (150 hours)
CSLG 7435 - Internship in Counseling (3) (300 hours) *(taken twice)*

Elective Courses (12 credit hours)
These courses must be approved by the student's advisor.

Secondary Concentration *(Optional)* (12 credit hours)

Play Therapy Concentration

The Concentration in Play Therapy consists of a coherent program of play therapy coursework of 4 courses (12 credit hours). The concentration is an add-on, secondary concentration for students in the counseling programs. Students may add this secondary concentration to their primary concentration (Addiction, Clinical Mental Health, or School Counseling) by completing an Academic

Petition.

Required Courses (9 credit hours)
CSLG 7142 - Introduction to Play Therapy (3)

Plus two of the following:
CSLG 7143 - Filial Therapy: An Approach to Parent Training (3)
CSLG 7144 - Contemporary Theories of Play Therapy (3)
CSLG 7147 - Multicultural and Social Justice Issues in Play Therapy (3)

Elective Course (3 credit hours)
Select one of the following:
CSLG 7145 - Special Topics in Play Therapy (3)
Remaining course not taken above (CSLG 7143, CSLG 7144, or CSLG 7147)
Other course approved by the Director of the Play Therapy concentration

Degree Total = 60 Credit Hours

Comprehensive Exam
Students must successfully pass the Counselor Preparation Comprehensive Exam (CPCE) to graduate from the program. Students are expected to consult with their advisors during the first 24 hours of coursework concerning procedures and preparation for this experience.

Advising
All students should plan their program of study by December of their first year of study with their advisors.

Licensure
Students who graduate from the School Counseling concentration are eligible, upon passing the exam required by the North Carolina Department of Public Instruction (DPI), to be recommended for school counseling licensure from the North Carolina DPI. All graduates are eligible to apply for the credential of Licensed Professional Counselor Associate (LPCA) through the NCBLPC upon completion of the application and required exam.

Post-Master's Certificate in Addiction Counseling

The Post-Master's Certificate in Addiction Counseling is designed to prepare students to assist those in need of counseling due to addiction.

Admission Requirements
This certificate program admits practitioners who hold a master's degree in counseling from a CACREP-accredited graduate degree program. In addition to the general requirements for admission to a certificate program, applicants must provide official transcripts, three letters of recommendation from persons familiar with the applicant's personal and professional qualifications, and an essay describing the applicant's relevant experience and objectives in undertaking the Post-Master's Certificate in Addiction Counseling program.

Applications for admission to the certificate program are considered as they are received and admissions are ongoing. Students are admitted to the Graduate School in a special category for certificate students.

Certificate Requirements
Required Courses (9 credit hours)
CSLG 6160 - Theories of Addiction (3)
or CSLG 8160 - Theories of Addiction (3)
CSLG 6161 - Assessment and Diagnosis of Addictive Disorders (3)
or CSLG 8161 - Assessment and Diagnosis of Addictive Disorders (3)
CSLG 6162 - Inventions in Addiction Counseling (3)
or CSLG 8162 - Inventions in Addiction Counseling (3)

Elective Course (3 credit hours)
Select one of the following:
CSLG 6163 - Treatment Planning and Relapse Prevention in Addiction Counseling (3)
or CSLG 8163 - Treatment Planning and Relapse Prevention in Addiction Counseling (3)
CSLG 6164 - The McLeod Institute on Addiction (3)
CSLG 8164 - The McLeod Institute on Addiction (3)

Field Experience Requirement (3 credit hours)
300 hours of supervised field experiences in substance use disorder treatment is required. *Select one of the following:*

CSLG 7435 - Internship in Counseling (3)
CSLG 8440 - Doctoral Internship: Counseling (3)

Certificate Total = 15 Credit Hours

Graduate Certificate in Play Therapy

The Graduate Certificate in Play Therapy program is designed to prepare students to work with children who are 10 years and younger in a developmentally appropriate way in both school counseling and community settings. It is available for students who have completed a master's degree in counseling, social work, or psychology and want additional training in play therapy. In addition, the program is available for students in other departments at

UNC Charlotte and students at other universities in their M.A. and Ph.D. programs.

The Graduate Certificate in Play Therapy meets the educational requirements as specified by the Association for Play Therapy (APT) for the Registered Play Therapist (RPT) credential. The Graduate Certificate is recognition of academic achievement and enhances professional standing.

Admission Requirements

1) An earned master's degree in counseling, social work, or psychology from a college or university accredited by an accepted accrediting body
2) Online application to Graduate Admissions accompanied by the application fee in effect
3) GPA required for entry into a master's degree program
4) Official transcripts
5) Personal statement of interest

The program adheres to Graduate School Admissions deadlines. Please note that classes may fill before the Graduate School's final deadlines. Students are admitted to the Graduate School in a special category for Graduate Certificate students and must comply with all policies and regulations of the Graduate School from the time they are admitted until they graduate.

Certificate Requirements

Core Course (3 credit hours)

CSLG 7142 - Introduction to Play Therapy (3)

Elective Courses (9 credit hours)

Select two of the following:

CSLG 7143 - Child-Centered Relationship Training: An Approach for Parents/Caregivers/Teachers (3)
CSLG 7144 - Contemporary Theories of Play Therapy (3)
CSLG 7147 - Multicultural and Social Justice Issues in Play Therapy (3)

Plus one of the following:

CSLG 7145 - Special Topics in Play Therapy (3)
The remaining Elective Course not taken above
Other course approved by the Graduate Program Director of the Graduate Certificate in Play Therapy

Certificate Total = 12 Credit Hours

Post-Master's Certificate in School Counseling

The Post-Master's Certificate in School Counseling provides graduate level coursework related to school counseling. Successful completion of the program requirements enables the counselor to be recommended for licensure in school counseling from the North Carolina Department of Public Instruction. A minimum of 12 credit hours is required for the post-master's certificate. All coursework applied to a certificate must be completed within five years. Transfer credit is not accepted into the certificate program.

This program has been designed for counselors who want to become eligible for licensure as school counselors by the Department of Public Instruction in North Carolina. The completion of this program, in addition to passing the PRAXIS II Specialty Area Test for School Counselors, qualifies students to become licensed School Counselors. In addition to the required courses, an additional internship may be required should the student need further clinical training. Any additional coursework is based on the individual review of each applicant's graduate transcript(s) and selected program option.

The certificate program is available online through Distance Education only for those applicants from CACREP-approved programs who qualify for CAS-level licensure [Options A and B]. Visit distanceed.charlotte.edu for additional information.

Admission Requirements

1) A master's degree in counseling from a college or university accredited by an accepted accrediting body in Agency Counseling, Clinical Mental Health Counseling, Community Counseling, or Rehabilitation Counseling
2) Written application to Graduate Admissions accompanied by the application fee in effect
3) A Statement of Purpose
4) Letter(s) of Recommendation
5) Official transcripts (undergraduate/graduate)

Candidates wishing to begin in Summer or Fall semesters must submit their application by March 1 to the Graduate School.

Certificate Requirements

Program Options

Option A

For counselors who graduated from a 60 credit CACREP accredited program in Agency Counseling, Clinical Mental Health Counseling, Community Counseling, or Rehabilitation Counseling.

Based on a review of the applicant's transcript, a program of study is designed that indicates the counselor has completed the below Course Requirements.

Upon successful completion of Option A and a passing score on the PRAXIS II test, candidates are eligible for CAS-level Licensure in School Counseling.

Option B
For counselors who graduated from CACREP accredited programs in Agency Counseling, Clinical Mental Health Counseling, Community Counseling, or Rehabilitation Counseling with less than 60 credit hours.

Based on a review of applicant's transcript, a program of study is designed that is equivalent to a 60 credit school counseling program, including the below Course Requirements.

Upon successful completion of Option B and a passing score on the PRAXIS II test, candidates are eligible for CAS-level Licensure in School Counseling.

Option C
For counselors who graduated from non-accredited counseling programs in Agency Counseling, Clinical Mental Health Counseling, Community Counseling, or Rehabilitation Counseling.

Based on a review of applicant's transcript, a program of study is designed that is equivalent to a 48 credit school counseling program, including the below Course Requirements.

Candidates successfully completing Option C and passing the PRAXIS II test are eligible for M-level Licensure.

Required Courses (12 credit hours)
CSLG 7140 - Consultation in School Counseling (3)
CSLG 7141 - The Professional School Counselor (3)
CSLG 7436 - Advanced Internship in School Counseling (3)
CSLG 7646 - Administration and Leadership of School Counseling Services (3)

Certificate Total = 12 Credit Hours

Additional Program Requirements and Information
In addition to completing required courses, students must pass the PRAXIS II Specialty Area Test for School Counseling to qualify for state licensure. Registration and information are available at ets.org.

Upon completion of all coursework and passing the PRAXIS II, candidates are admitted to candidacy and must apply for graduation at the start of their last semester. Candidates must also make application for their school counseling license a month prior to program completion in the TEAL Office.

CURRICULUM AND INSTRUCTION/ MIDDLE GRADES AND SECONDARY EDUCATION

- Ph.D. in Curriculum and Instruction
  - Curriculum and Educator Development (CED)
  - Learning, Design, and Technology (LDT)
  - Literacy Education
  - Mathematics Education
  - Urban Education
- M.Ed. in Curriculum and Instruction
  - Middle Grades Education
  - Secondary Education
  - Teaching English as a Second Language
  - Curriculum Leadership
- Master of Arts in Teaching (M.A.T.) - Middle Grades and Secondary Education
  - Middle Grades Education
  - Secondary Education
- Graduate Certificate in Teaching – Middle Grades and Secondary Education
  - Middle Grades English Language Arts
  - Middle Grades Mathematics
  - Middle Grades Science
  - Middle Grades Social Studies
  - Secondary English Language Arts
  - Secondary Mathematics
  - Secondary Science
  - Secondary Social Studies
  - Career and Technical Education Business
  - Career and Technical Education Family and Consumer Sciences
  - Career and Technical Education Marketing
  - Career and Technical Education Technology
- Graduate Certificate in Teaching – Art Education
- Graduate Certificate in Common Core Instruction
- Graduate Certificate in National Board Certification

Department of Middle, Secondary, and K-12 Education

mdsk.charlotte.edu

Ph.D. in Curriculum and Instruction

The Ph.D. in Curriculum and Instruction is designed to prepare teacher education faculty and other educational professionals for work in various agency and educational settings. The program is interdisciplinary and involves faculty from across the University campus, and primarily the Departments of English; Mathematics and Statistics; Middle, Secondary, and K-12 Education; Reading and Elementary Education; and Educational Leadership. The program focuses on urban issues and perspectives related to curriculum and instruction with concentrations in:

- Curriculum and Educator Development (CED) (includes Elementary Education)
- Learning, Design, and Technology (LDT)
- Literacy Education (oriented toward Reading Education, English Education, or Teaching English as a Second Language)
- Mathematics Education
- Urban Education

Studies include a substantive core in urban education and educational research. Students may focus their study on education for learners at elementary, middle grades, secondary, K-12, or post-secondary/adult levels.

Each concentration in the Ph.D. in Curriculum and Instruction offers UNC Charlotte graduate students and alumni the opportunity to apply for Advanced Standing. For more information, see Advanced Standing below.

Curriculum Objectives

- Lead inquiry into the nature of curriculum theory and the relationship that theory has upon the major sources, components, and processes required in curriculum development, particularly within expanding urban-regional environments.
- Demonstrate relationships among curriculum theory and design, models of and research about teaching and learning, variations among learners, and the ideological, social, and disciplinary contexts of teaching and learning, including the influence on urban-regional schools, state and national policies, curriculum philosophy, and political pressures.
- Guide curriculum development and evaluation in its pragmatic context by applying curriculum theory, policy, and practice for diverse learners within a variety of educational settings.

Research and Evaluation Objectives

- Use appropriate quantitative and qualitative research methods to solve problems in urban education and related disciplines, detect new patterns, and assess the effectiveness of instructional programs and teaching methodologies for all learners.
- Communicate research and evaluation findings in a variety of written and electronic formats, such as evaluation reports, professional articles, grant proposals, conference presentations, and technical reports, with the consistent underlying purpose of supporting educational effectiveness and reform in urban-regional environments.

Specialty Objectives

- Apply theory and research in one's area of specialization to detecting new patterns, identifying problems, and solving urban-regional problems of curriculum, teaching, learning, and assessment through collaborative problem identification, research projects, policy formation, and professional development.
- Exhibit sustained intellectual curiosity, broad understandings, specialized knowledge, and professional commitments pertaining to one's selected area of specialization within the context of urban-regional schools.

Admission Requirements

Applicants should submit a current vitae and a professional writing sample. A review committee will conduct an initial review of application materials and recommend selected applicants for on-campus interviews. The selection committee will then make final recommendations to the Graduate School relative to acceptance into the program based on the merits of the application materials and the interview process.

Prerequisite Requirements

The intended audience for the Ph.D. in Curriculum and Instruction includes education professionals who hold the master's degree. It is anticipated that most applicants will be experienced teachers or school leaders with the North Carolina "G" or "M" license or equivalent licenses from other states. However, the program will welcome and accommodate non-licensed candidates with appropriate professional experiences who have been involved in teaching or educational program development and evaluation.

Degree Requirements

The Ph.D. in Curriculum and Instruction requires a minimum of 60 credit hours of coursework, including the dissertation. Students must maintain a cumulative average

of 3.0 in all coursework taken. An accumulation of more than two C grades will result in termination of enrollment in the graduate program. If students make a grade of U in any course, enrollment in the program will be terminated.

The program will consider the transfer of a limited number of courses from a college or university accredited by an accepted accrediting body (typically no more than six credit hours), providing the Curriculum and Instruction Committee determines that the course or courses to be transferred are appropriate for the program of study and are graduate-level courses beyond the master's degree. Grades for these transfer courses must be an A or B. All dissertation work must be completed at UNC Charlotte.

Students must successfully complete requirements for the comprehensive examination and dissertation. All students must complete a residency requirement of at least 18 credit hours over three successive terms of enrollment. Students must complete their degree, including dissertation, within nine years. The Ph.D. website (mdsk.charlotte.edu/academic-programs/phd-ci) contains additional information, including updated planning sheets for each concentration.

Foundation Course (3 credit hours)

The program requires all students in each concentration, including Advanced Standing, complete in the first year a pro-seminar in curriculum, instruction, and urban education leadership.

EDCI 8620 - Pro-Seminar in Curriculum, Instruction, and Urban Education Leadership (3)

Urban Core Courses (12-15 credit hours)

Each concentration requires core coursework in Urban Foundations. The Urban Education concentration requires 15 credit hours. Mathematics Education; Literacy Education; Curriculum and Educator Development (CED); and Learning, Design, and Technology (LDT) concentrations require 12 credit hours.

EDCI 8180 - Critical Issues and Perspectives in Urban Education (3)
EDCI 8182 - Power, Privilege, and Education (3)
EDCI 8184 - Social Theory and Education (3)
EDCI 8186 - Globalization, Urbanization, and Urban Schools (3)
EDCI 8314 - Urban Educational Reform (3) *(required only for Urban concentration)*

Research Methodology Courses (15 credit hours)

Each concentration must also complete at least 15 credit hours of research coursework, which also count toward dissertation preparation hours. Please note that five courses are required but not necessarily sufficient.

Additional courses not listed require Graduate Program Director approval.

Required Courses

RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8210 - Applied Research Methods (3)

Elective Courses

Select three or more of the following:
EDCI 8121 - Applied Research Methods in the Teaching of English (3)
EDCI 8250 - Applied Research in Literacy Education (3)
RSCH 8111 - Qualitative Research Methods (3)
RSCH 8112 - Survey Research Methods (3)
RSCH 8113 - Single-Case Research (3)
RSCH 8120 - Advanced Statistics (3)
RSCH 8121 - Qualitative Data Collection and Analysis (3)
RSCH 8130 - Presentation and Computer Analysis of Data (3)
RSCH 8140 - Multivariate Statistics (3)
RSCH 8150 - Structural Equation Modeling (3)
RSCH 8196 - Program Evaluation Methods (3)

Concentration Courses (18-21 credit hours)

There are five concentrations available within the Ph.D. in Curriculum and Instruction program:

1) Curriculum and Educator Development (CED)
2) Learning, Design, and Technology (LDT)
3) Literacy Education (oriented toward Reading Education, English Education, or Teaching English as a Second Language)
4) Mathematics Education
5) Urban Education

Each of the available concentrations offers a variety of required and concentration-specific course offerings at the doctoral level. Each concentration must also complete specialization coursework specific to the concentration.

Curriculum and Educator Development (CED) Concentration (21 credit hours)

Required Courses (15 credit hours)
EDCI 8156 - Critical Issues in K-12 Curriculum and Instruction (3)
EDCI 8157 - Analysis of Inquiry in Curriculum, Instruction, and Educator Development (3)
EDCI 8475 - College Co-Teaching Internship in Curriculum and Instruction (3)
EDCI 8650 - Critical Readings in Elementary, Middle Grades, and Secondary Education Research (3)
EDCI 8681 - Seminar in College Teaching (3)

Elective Courses (6 credit hours)
Select from the following, in consultation with the Program Advisor. Students may enroll in graduate-level credit outside of this list with approval of the Program Advisor.

EDCI 8070 - Topics in Urban Educational Leadership (3)
EDCI 8080 - Topics in Curriculum, Instruction and Educator Development (3)
EDCI 8084 - Topics and Research in Social Studies Education (3)
EDCI 8113 - Research in Mathematics Education (3)
EDCI 8120 - Literacy and Educational Public Policy (3)
EDCI 8129 - Linguistics and Language Learning (3)
EDCI 8133 - Multiculturalism and Children's Literature (3)
EDCI 8152 - Varieties of Constructivism in Elementary Education (3)
EDCI 8153 - Pro-Seminar in Elementary Education (3)
EDCI 8154 - History of Education in America (3)
EDCI 8155 - Using Process and Outcome Data to Drive Continuous School Improvement (3)
EDCI 8158 - Research in Curriculum, Instruction, and Educator Development (3)
EDCI 8225 - Topics and Issues in Middle Grades Education (3)
EDCI 8314 - Urban Educational Reform (3)
EDCI 8462 - Supervision of Student Teachers (3)
EDCI 8485 - College Teaching and Professional Development Internship (3)
EDCI 8655 - Seminar on Practice-Based Teacher Education and the Science of Learning (3)
EDCI 8682 - Seminar in Professional and Grant Writing (3)
EDCI 8850 - Independent Study in Curriculum and Educator Development (3)
ADMN 8130 - Educational Governance and Policy Studies (3)
ADMN 8160 - Introduction to Educational Administration (3)
MDSK 6142 - Readings in Assessment, Measurement, and Student Achievement (3)
PPOL 8689 - The Social Context of Schooling (3)

Learning, Design and Technology (LDT) Concentration (21 credit hours)

Required Courses (6 credit hours)

ADMN 8695 - Advanced Seminar in Teaching and Learning (3)
ELDT 8102 - Research in Learning, Design, and Technology (3)

Elective Courses (15 credit hours)

Select from the following, in consultation with the Program Advisor. Students may enroll in graduate-level credit outside of this list with approval of the Program Advisor.

ELDT 8000 - Topics in Learning, Design, and Technology (1 to 6)
ELDT 8100 - Foundations of Learning, Design, and Technology (3)
ELDT 8110 - Instructional Design (3)
ELDT 8120 - Current Trends in Learning, Design, and Technology (3)
ELDT 8121 - Advanced Instructional Design (3)
ELDT 8130 - Instructional Multimedia Development (3)
ELDT 8135 - Learning Media, Resources and Technology (3)
ELDT 8140 - Instructional Video Development (3)
ELDT 8150 - Design, Development, and Evaluation of Online Learning Systems (3)
ELDT 8160 - Designing Learning Systems with Simulation and Game Technology (3)
ELDT 8170 - Human Performance Technology (3)
ELDT 8800 - Individual Study in Learning, Design, and Technology (1 to 6)
EDCI 8681 - Seminar in College Teaching (3)

Literacy Education Concentration (24 credit hours)

Select from the following. Concentration Coordinator consultation is required to enroll in the below courses. Students may enroll in graduate-level credit outside of the below list with approval of the Program Advisor.

ADMN 8101 - Perspectives on Adult Learning Theory (3)
EDCI 8040 - Topics in Reading Education (3)
EDCI 8070 - Topics in Urban Educational Leadership (3)
EDCI 8120 - Literacy and Educational Public Policy (3)
EDCI 8129 - Linguistics and Language Learning (3)
EDCI 8131 - Research in English Studies (3)
EDCI 8132 - Research in Literary Theory (3)
EDCI 8133 - Multiculturalism and Children's Literature (3)
EDCI 8134 - Early Black American Literature (3)
EDCI 8135 - African American Literary Theory and Criticism (3)
EDCI 8137 - Language and Culture (3)
EDCI 8138 - Comparative Language Study (3)
EDCI 8139 - Perspectives in African American Literature (3)
EDCI 8140 - Current Issues and Practices in Literacy Education (3)
EDCI 8183 - Teaching English as a Second Language (3)
EDCI 8201 - Perspectives in Immigration and Urban Education (3)
EDCI 8206 - Globalization, Communities, and Schools (3)
EDCI 8252 - K-12 Writing Development and Instruction (3)
EDCI 8254 - Collaborative Leadership in Literacy Education (3)
EDCI 8255 - Middle/Secondary Reading and Writing (3)
EDCI 8256 - Diagnostic Assessment and Instruction in Reading (3)
EDCI 8260 - History and Psychology of Racism (3)
EDCI 8261 - Racial Identity Development (3)
EDCI 8262 - Race in Education and Schooling (3)
EDCI 8263 - Anti-Racism Activism in Education (3)
EDCI 8265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
EDCI 8420 - Writing Program Administration and Supervision (3)
EDCI 8462 - Supervision of Student Teachers (3)
EDCI 8475 - College Co-Teaching Internship in Curriculum and Instruction (3)

EDCI 8485 - College Teaching and Educator Development Internship (3)
EDCI 8640 - Readings in Literacy Research (3)
EDCI 8681 - Seminar in College Teaching (3)
EDCI 8682 - Seminar in Professional and Grant Writing (3)
EDCI 8840 - Independent Study in Reading, Language, and Literacy (3)
ENGL 6008 - Topics in Advanced Technical Communication (3)
ENGL 6062 - Topics in Rhetoric (3)
ENGL 6070 - Topics in English (3)
ENGL 6103 - Introduction to Children's Literature and Culture (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6116 - Technical/Professional Writing (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6127 - Seminar in Language, Culture, and Society (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
TESL 6000 - Topics in Teaching English as a Second Language (16)

Mathematics Education Concentration (21 credit hours)
Required Courses (18 credit hours)
EDCI 8112 - Theoretical Foundations of Learning Mathematics (3)
EDCI 8113 - Research in Mathematics Education (3)
EDCI 8114 - Advanced Topics in Mathematics Education (3)
EDCI 8115 - Issues in the Teaching of Secondary School Mathematics (3)
EDCI 8160 - Readings in Mathematics Education (3)
EDCI 8609 - Curriculum and Instruction Seminar (3)

Elective Course (3 credit hours)
Select from the following. Students may enroll in 3 credit hours of graduate-level courses outside of the below list with approval of the Program Advisor.

EDCI 8004 - Topics in Analysis (3)
EDCI 8008 - Topics in Geometry and Topology (3)
EDCI 8101 - Foundation of Mathematics (3)
EDCI 8102 - Real Analysis for Secondary Mathematics Teachers (3)
EDCI 8103 - Computer Techniques and Numerical Methods (3)
EDCI 8105 - Problem Solving in Discrete Mathematics (3)
EDCI 8106 - Modern Algebra for Secondary Mathematics Teachers (3)
EDCI 8107 - Linear Algebra for Secondary Mathematics Teachers (3)
EDCI 8118 - Non-Euclidean Geometry (3)
EDCI 8860 - Independent Study in Mathematics Education (3)

Urban Education Concentration (18 credit hours)
Select from the following. Students may enroll in 6 credit hours of courses outside of this list with approval of the Program Advisor.

EDCI 8061 - Topics in Urban Educational Research (3)
EDCI 8070 - Topics in Urban Educational Leadership (3)
EDCI 8075 - Topics in Urban-Regional Education (3)
EDCI 8133 - Multiculturalism and Children's Literature (3)
EDCI 8134 - Early Black American Literature (3)
EDCI 8139 - Perspectives in African American Literature (3)
EDCI 8300 - Social Stratification and Urban Schools and Communities (3)
EDCI 8310 - Transformative Black Education (3)
EDCI 8311 - Critical Readings in Urban Education Research (3)
EDCI 8312 - Urban Schooling, Curriculum, and Pedagogy (3)
EDCI 8320 - Social Deviance, Delinquency, and Education (3)
EDCI 8330 - History of Urbanization and Its Impact on Schooling (3)
EDCI 8460 - Internship in Urban Education (3)
EDCI 8660 - Readings in Urban Educational Research (3)
EDCI 8682 - Seminar in Professional and Grant Writing (3)
EDCI 8880 - Independent Study in Urban Education (1 to 3)

Dissertation Courses (9 credit hours)
All concentrations must complete 9 credit hours of dissertation coursework.

EDCI 8699 - Dissertation Proposal Seminar (3) *(taken after successful completion of the comprehensive examinations and pre-proposal meeting with committee members)*
EDCI 8999 - Dissertation Research (3) *(minimum of 6 credit hours; taken after the appointment of the dissertation committee and successful completion of the dissertation proposal defense)*

Degree Total = 60 Credit Hours

Advanced Standing Option

The Ph.D. in Curriculum and Instruction offers Charlotte graduate students and alumni of UNC Charlotte the opportunity to apply for Advanced Standing. Advanced Standing recognizes relevant coursework from approved Charlotte master's degrees. Doctoral students accepted with Advanced Standing into the Ph.D. in Curriculum and Instruction complete a minimum of 48 credit hours of coursework, including the dissertation. No transfer credits are allowed for Advanced Standing students. Advanced

Standing students must select a concentration in the application process.

Advanced Standing Admission Requirements

To be admitted to Advanced Standing for the Ph.D. in Curriculum and Instruction program, students must meet the admission requirements of the Ph.D. and must have earned a master's degree from UNC Charlotte in a field related to one of the degree concentrations: (1) Curriculum and Educator Development (CED) (including Elementary Education), (2) Learning, Design, and Technology (LDT), (3) Literacy Education (oriented toward Reading Education, English Education, or Teaching English as a Second Language), (4) Mathematics Education, or (5) Urban Education. Only students who have earned a master's degree within the last ten years in one of the approved UNC Charlotte graduate programs will be considered. All other students should apply to the Ph.D. in Curriculum and Instruction program (without the Advanced Standing option).

Approved UNC Charlotte master's degree programs for Advanced Standing in the Ph.D. in Curriculum and Instruction include:

- M.Ed. in Curriculum and Instruction
- M.Ed. in Elementary Education
- M.Ed. in Learning, Design, and Technology
- M.Ed. in Instructional Systems Technology
- M.Ed. in Middle and Secondary Grades
- M.Ed. in Reading Education
- M.Ed. in Teaching English as a Second Language
- M.Ed. in Urban Education
- M.A. in English
- M.A. in Mathematics
- M.S. in Mathematics

Advanced standing students must have a minimum grade of B in master's degree coursework pertinent to the Ph.D. in Curriculum of Instruction. Additionally, students with a cumulative GPA less than 3.5 in their master's degree or 2 or more grades of C are not eligible for Advanced Standing. In this case, students have the option of requesting transfer of credit hours for individual courses with grades of B or above after acceptance into the 60 credit hour Ph.D. in Curriculum and Instruction degree program.

Students who have successfully completed an approved master's degree at Charlotte and meet GPA and grade requirements are eligible to apply for Advanced Standing in the Ph.D. in Curriculum and Instruction.

Advanced Standing Degree Requirements

The Ph.D. in Curriculum and Instruction requires a minimum of 60 credit hours of coursework, including the dissertation. The degree requirements for the Advanced Standing are similar to the Ph.D. in Curriculum and Instruction except students complete a minimum of 48 credit hours. No transfer credits are allowed for Advanced Standing students. All Advanced Standing students select a concentration which determines the Advanced Standing program requirements and specialization. All Advanced Standing students must complete the foundations course (EDCI 8620) in the first year of their program.

Advanced Standing students must maintain a cumulative average of 3.0 in all coursework taken. An accumulation of more than two C grades will result in termination of enrollment in the graduate program. If students make a grade of U in any course, enrollment in the program will be terminated. For Advanced Standing, courses taken at the master's 5000- or 6000-level cannot be repeated at the doctoral 8000-level. In this case, Advanced Standing students should work with concentration advisors to determine appropriate program electives or course substitutions if necessary. All course substitutions require submission of an academic petition and Graduate Program Director approval.

Advanced Standing students must successfully complete requirements for the Qualifying Comprehensive Examination and dissertation. All Advanced Standing students must complete a residency requirement of at least 18 credit hours over three successive terms of enrollment. Advanced Standing students must complete their degree, including dissertation, within nine years. The Ph.D. website at mdsk.charlotte.edu/academic-programs/phd-curriculum-and-instruction/prospective-students contains additional information, including updated planning sheets for each Advanced Standing concentration.

Advanced Standing Foundation Course (3 credit hours)

Advanced Standing students in each concentration complete in the first year a pro-seminar in curriculum, instruction, and urban education leadership.

EDCI 8620 - Pro-Seminar in Curriculum, Instruction, and Urban Education Leadership (3)

Advanced Standing Urban Core Courses (9-15 credit hours)

Like all Ph.D. in Curriculum and Instruction students, Advanced Standing students complete core coursework in Urban Foundations. For Advanced Standing students, the Urban Education concentration requires 15 credit hours. All other concentrations [Curriculum and Educator Development (CED); Learning, Design, and Technology (LDT); Literacy Education; and Mathematics Education] require Advanced Standing students complete 9 credit hours in urban core coursework.

Students who enter the Ph.D. in Curriculum and Instruction as Advanced Standing must take the Qualifying Comprehensive Examination before the end of their fourth semester in the doctoral program. The Curriculum and Instruction Qualifying Comprehensive Examination includes three parts: Urban Core, Research, and Specialization. The first part of the examination, the Urban Core, covers substantive course content and additional readings, research, and research methodologies from the required urban core courses. While not required for all concentrations in Advanced Standing degree, the program recommends students complete EDCI 8186 or an equivalent course at the Master's level to be prepared for the urban core comprehensive examination. Like all Ph.D. in Curriculum and Instruction students, Advanced Standing students are expected to complete additional readings in urban education to prepare for the Qualifying Comprehensive Examination.

EDCI 8180 - Critical Issues and Perspectives in Urban Education (3)
EDCI 8182 - Power, Privilege, and Education (3)
EDCI 8184 - Social Theory and Education (3)
EDCI 8186 - Globalization, Urbanization, and Urban Schools (3) (required only for Urban concentration; recommended for other concentrations)
EDCI 8314 - Urban Educational Reform (3) (required only for Urban concentration)

Advanced Standing Research Methodology and Dissertation Courses (18-21 credit hours)

Advanced Standing students must complete at least 9-12 credit hours of research methodology coursework and a minimum of 9 credit hours of dissertation preparation. For Advanced Standing in the Mathematics Concentration, students are required to complete 9 credit hours of research methodology coursework. All other concentrations [Curriculum and Educator Development (CED); Learning, Design, and Technology (LDT); Literacy Education; and Urban Education] require 12 credit hours in research methodology coursework.

Similar to all students in the Ph.D. in Curriculum and Instruction program, Advanced Standing students have two required research methodology courses. With approval of the Concentration Coordinator and Program Advisor, Advanced Standing students select one or two courses from the research methodology elective courses listed for the Ph.D. in Curriculum and Instruction. Research courses should be specific to either quantitative or qualitative research methods, depending on dissertation plans. Please note that three to four research methodology courses are required but may not be sufficient. The Program Advisor may recommend additional research courses in preparation for the dissertation. Research courses not listed within program electives require submission of an academic petition and Graduate Program Director approval.

All Advanced Standing students must complete 9 credit hours of dissertation coursework including a 3-credit hour dissertation proposal seminar and a minimum of 6 credit hours of dissertation research. The dissertation proposal seminar should be taken after successful completion of all parts of the Qualifying Comprehensive Examination (Urban Core, Research, and Specialization), appointment of the dissertation committee, and pre-proposal meeting with dissertation committee members.

RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8210 - Applied Research Methods (3)
EDCI 8699 - Dissertation Proposal Seminar (3) *(taken after successful completion of the comprehensive examinations, appointment of the dissertation committee, and pre-proposal meeting with dissertation committee members)*
EDCI 8999 - Dissertation Research (3) *(minimum of 6 credit hours; taken after the appointment of the dissertation committee and successful completion of the dissertation proposal defense)*

Advanced Standing Concentration Courses (9-18 credit hours)

Advanced Standing students must complete specialization coursework specific to their concentration. There are five concentrations available within the Ph.D. in Curriculum and Instruction program for Advanced Standing students:

- Curriculum and Educator Development (CED) (includes Elementary Education)
- Learning, Design, and Technology (LDT)
- Literacy Education (oriented toward Reading Education, English Education, or Teaching English as a Second Language)
- Mathematics Education
- Urban Education

Each concentration offers a variety of concentration-specific course offerings at the doctoral level which are listed under the concentration requirements and electives for all students in the Ph.D. in Curriculum and Instruction program.

All Advanced Standing students are required to meet with the Concentration Coordinator and Program Advisor for identification of specialization courses. For Advanced Standing, courses taken at the master's 5000 or 6000-level cannot be repeated at the doctoral 8000-level to meet concentration requirements.

The number of required credit hours varies by concentration. For Advanced Standing, the Mathematics Education concentration requires 18 credit hours in

specialization coursework. The Curriculum and Educator Development (CED); Learning, Design, and Technology (LDT); and Literacy Education concentrations require 15 credit hours in specialization coursework for Advanced Standing students. The Urban Education concentration requires Advanced Standing students complete 9 credit hours in their specialization.

Advanced Standing students in the Curriculum and Educator Development (CED); Learning, Design, and Technology (LDT); or Mathematics Education concentrations are expected to complete concentration required courses first, and then select from concentration electives listed in the Ph.D. in Curriculum and Instruction information for the remaining concentration credit hours if applicable. All decisions regarding concentration courses require Concentration Coordinator and Program Advisor approval.

The Advanced Standing Literacy Education concentration and Urban Education concentration require students, with approval of the Program Advisor, to select courses from the concentration electives to meet specialization requirements in the Ph.D. in Curriculum and Instruction.

Advanced Standing students should schedule an advising meeting in the first semester to map out a program of study using Advanced Standing concentration planning sheets. The Ph.D. website at mdsk.charlotte.edu/academic-programs/phd-curriculum-and-instruction/prospective-students contains additional information, including updated planning sheets for each Advanced Standing concentration.

A minimum of 48 credit hours are required to complete the Ph.D. in Curriculum and Instruction degree under the Advanced Standing option. Once the minimums are satisfied, the remaining hours, if any, can be satisfied via elective coursework within the concentration area of study pending Concentration Coordinator and Program Advisor approval. Courses outside the program of study and concentration require submission of an academic petition and Graduate Program Director approval.

Advanced Standing Degree Total = 48 Credit Hours

Advising

An Advisor is assigned to each student within the first year of study. The Advisor, Concentration Coordinator, and Program Director provide initial advising until the end of the first year (12 credit hours) when the Advisor assumes responsibility. By the beginning of the second year, the student is required to submit a Program of Study which is approved by the Advisor, Concentration Coordinator, and Program Director. The Advisor, Concentration Coordinator, and Program Director also support the student in identifying faculty whose research interests and expertise are congruent with the student's probable area of dissertation inquiry. The assistance of the Advisor does not relieve the student of responsibility for completing required work and for following departmental or University procedures. In the semester in which the student takes the Qualifying Comprehensive Examination, the student reaches agreement with a faculty member to serve as dissertation chair. The chair must be a member of the Curriculum and Instruction faculty. Students should complete the Qualifying Comprehensive Examination by the end of the third year in the program. Students who enter the Ph.D. program under Advanced Standing must take the Qualifying Comprehensive Examination before the end of their fourth semester in the doctoral program.

Admission to Candidacy

Students are considered candidates for the doctoral degree upon: (a) successful completion of the Qualifying Comprehensive Examination and (b) approval of the Dissertation Proposal. Candidacy must be achieved the semester before the degree is conferred.

Application for Degree

Students must submit an Application for Degree in the semester in which they successfully defend their dissertation proposal. Adherence to Graduate School deadlines and requirements is expected. Degree requirements are completed with the successful defense of the dissertation and when the final copy of the dissertation has been filed in the Graduate School.

M.Ed. in Curriculum and Instruction

The Master of Education in Curriculum and Instruction is designed for experienced licensed teachers in middle grades, secondary education, and Teaching English as a Second Language in schools who desire advanced study in content and pedagogy, and seek an opportunity to integrate advanced study with their teaching experiences. In addition, the program includes a Curriculum Leadership concentration for non-licensed educators who seek to expand their knowledge of curriculum and instruction. Candidates acquire the skills, knowledge, dispositions, and abilities required to assume a leadership role.

Program Goals

Successful graduates possess a comprehensive pedagogical, conceptual, and reflective knowledge base that can be applied to their classrooms through effective instruction, responsivity, and collaboration. This developed and applied knowledge is, in turn, shared with other professionals through a variety of leadership opportunities.

Both the College's Conceptual Framework and the following goals provide structure for the entire program.

Program graduates are able to:

1) Self-direct their personal and professional growth
2) Respond effectively to adolescent differences, equity and diversity, and global learning communities
3) Demonstrate advanced pedagogical content knowledge of the curriculum, as well as apply 21st Century knowledge, skills, and technical expertise
4) Improve educational practice through critical self-reflection, self-assessment, and applied research
5) Work collaboratively with colleagues, professionals, parents, guardians, families and individuals charged with the well-being of learners
6) Assume a leadership role at the local, district, regional, state, or national level

National Board for Professional Teaching Standards Connections

A unique feature of this program is its strategic alignment with core propositions, skill sets, academic language, and concepts from the National Board for Professional Teaching Standards (NBPTS). Activities are designed to provide information and support to potential and current candidates. They also account for recent certification program changes by the NBPTS.

Admission Requirements

- A bachelor's degree from a college or university accredited by an accepted accrediting body
- For candidates who will apply for the North Carolina "M" license, a North Carolina "A" license (Standard Professional 1 [SP1] Professional Educator's License) in Middle Grades (6-9), Secondary Education (9-12), or English as a Second Language (ESL), or the equivalent from another state in both the concentration and content field of the program to which the candidate is making application
- Teaching experience in a middle grades or secondary classroom (Middle Grades or Secondary Education concentrations only)
- Candidates enrolled in the Curriculum Leadership concentration cannot apply for "M" license since the track is not designed to support advanced licensure
- An undergraduate GPA of 3.0 overall (on a 4.0 scale); if an applicant has earned or attempted a post-baccalaureate degree (i.e., master's, doctoral, or other), grades in that program will also be taken into consideration
- A written narrative providing a statement of purpose for master's degree study
- Satisfactory recommendations from three professional educators

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Degree Requirements

The M.Ed. in Curriculum and Instruction degree requires a total of 30 credit hours of coursework. Candidates must select and fulfill the requirements of one of four concentrations: (1) Middle Grades Education, (2) Secondary Education, (3) Teaching English as a Second Language (TESL), or (4) Curriculum Leadership. For the first three selected concentrations, the candidate's initial A license -- as issued by the state of North Carolina -- must match their concentration to receive an "M" license. Candidates enrolled in the Curriculum Leadership concentration will not be pursuing advanced licensure.

Middle Grades Education Concentration

Core Courses (18 credit hours)

MDSK 6156 - Curriculum, Teaching, and Contemporary Issues in Education (3)
MDSK 6220 - Adolescence and Learning (2 or 3)
MDSK 6260 - Teacher Leadership (3)
MDSK 6691 - Seminar in Professional Development (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Middle Grades Course (3 credit hours)

MDLG 6225 - Issues in Middle Grades Education (3)

Advanced Content Specialization and Advanced Methods Courses (6 credit hours)

Advanced Methods Course (3 credit hours)

Students select one of the following from their content concentration:

ENGL 6274 - Contexts and Issues in the Teaching of English (3)
MAED 6252 - Advanced Methods in Middle and Secondary Mathematics Education (3)
MDSK 6351 - Advanced Methods in Middle and Secondary Science (3)
MDSK 6354 - Advanced Methods in Middle and Secondary Social Studies (3)

Advanced Content Specialization Courses (3 credit hours)

Students select one of the following in their content area:

English

ENGL 5000-6999 - English Elective (3)
READ 5000-6999 - Reading Education Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
or EDCI 8265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)

Mathematics

MAED 5000-6999 - Mathematics Education Elective (3)
MATH 5000-6999 - Mathematics Elective (3)
STAT 5000-6999 - Statistics Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
MDSK 6251 - Issues in 6-12 Mathematics Education (3)

Science
BIOL 5000-6999 - Biology Elective (3)
CHEM 5000-6999 - Chemistry Elective (3)
ESCI 5000-6999 - Earth Science Elective (3)
GEOG 5000-6999 - Geography Elective (3)
PHYS 5000-6999 - Physics Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
MDSK 6250 - Issues in 6-12 Science Education (3)

Social Studies
AFRS 5000-6999 - Africana Studies Elective (3)
GEOG 5000-6999 - Geography Elective (3)
HIST 5000-6999 - History Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
POLS 5000-6999 - Political Science Elective (3)
RELS 5000-6999 - Religious Studies Elective (3)
WGST 5000-6999 - Women's and Gender Studies Elective (3)
MDSK 6254 - Issues in 6-12 Social Studies Education (3)

Advanced Specialization Pedagogy Course (3 credit hours)
A graduate-level pedagogy course should be chosen in consultation with student's advisor. Possible elective options include, and are limited to one of, the following:

EDUC 6000 - Topics in Education (1 to 6) *
EDUC 6102 - The Person and School in Urban Society (3)
EDUC 6144 - Introduction to National Board Certification (3)
EDUC 7126 - Comparative Education (3)
ELDT 5100 - Technology Integration in Education (3)
ELDT 6110 - Instructional Design (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
MDLG 6800 - Individual Study in Middle Grades Education (1 to 6)
MDSK 6142 - Readings in Assessment, Measurement, and Student Achievement (3)
RSCH 6109 - Assessment and Evaluation Methods (3)
RSCH 6110 - Descriptive and Inferential Statistics (3)
TESL 5103 - Methods in Teaching English as a Second Language (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)

** Students may repeat EDUC 6000 up to 6 credit hours and substitute these credit hours for courses within the Advanced Content Specialization or Advanced Specialized Pedagogy Areas.*

Secondary Education Concentration

Core Courses (18 credit hours)
MDSK 6156 - Curriculum, Teaching, and Contemporary Issues in Education (3)
MDSK 6220 - Adolescence and Learning (2 or 3)
MDSK 6260 - Teacher Leadership (3)
MDSK 6691 - Seminar in Professional Development (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Advanced Content Specialization and Advanced Methods Courses (9 credit hours)
Advanced Methods Course (3 credit hours)
Students select one from their content concentration:
ENGL 6274 - Contexts and Issues in the Teaching of English (3)
MAED 6252 - Advanced Methods in Middle and Secondary Mathematics Education (3)
MDSK 6351 - Advanced Methods in Middle and Secondary Science (3)
MDSK 6354 - Advanced Methods in Middle and Secondary Social Studies (3)

Advanced Content Specialization Courses (6 credit hours)
Students select two of the following in their content area:
English
ENGL 5000-6999 - English Elective (3)
READ 5000-6999 - Reading Education Elective (3)
MDSK 5000-6999 (3) - Middle and Secondary Education Elective *(topics course that is content specific)*
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
or EDCI 8265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)

Mathematics
MAED 5000-6999 - Mathematics Education Elective (3)
MATH 5000-6999 - Mathematics Elective (3)
STAT 5000-6999 - Statistics Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
MDSK 6251 - Issues in 6-12 Mathematics Education (3)

Science
BIOL 5000-6999 - Biology Elective (3)
CHEM 5000-6999 - Chemistry Elective (3)
ESCI 5000-6999 - Earth Science Elective (3)
GEOG 5000-6999 - Geography Elective (3)
PHYS 5000-6999 - Physics Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
MDSK 6250 - Issues in 6-12 Science Education (3)

Social Studies

AFRS 5000-6999 - Africana Studies Elective (3)
GEOG 5000-6999 - Geography Elective (3)
HIST 5000-6999 - History Elective (3)
MDSK 5000-6999 - Middle and Secondary Education Elective (3) *(topics course that is content specific)*
POLS 5000-6999 - Political Science Elective (3)
RELS 5000-6999 - Religious Studies Elective (3)
WGST 5000-6999 - Women's and Gender Studies Elective (3)
MDSK 6254 - Issues in 6-12 Social Studies Education (3)

Note: For students interested in teaching at the community college level, Master's degrees with concentrations in Mathematics Education and English Education are offered through the Departments of Mathematics & Statistics and English, respectively. Please see the individual M.S. in Mathematics and M.A. in English sections of the Graduate Catalog for details.

Advanced Specialized Pedagogy Course (3 credit hours)

Select a pedagogy course with advisor consultation. Possible elective options include, and are limited to, one of the following:

EDUC 6000 - Topics in Education (1 to 6) *
EDUC 6102 - The Person and School in Urban Society (3)
EDUC 6144 - Introduction to National Board Certification (3)
EDUC 7126 - Comparative Education (3)
ELDT 5100 - Technology Integration in Education (3)
ELDT 6110 - Instructional Design (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
MDSK 6142 - Readings in Assessment, Measurement, and Student Achievement (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
RSCH 6109 - Assessment and Evaluation Methods (3)
RSCH 6110 - Descriptive and Inferential Statistics (3)
SECD 6800 - Individual Study in Secondary Education (1 to 6)
TESL 5103 - Methods in Teaching English as a Second Language (3)

** Students may repeat EDUC 6000 up to 6 credit hours and substitute these credit hours for courses within the Advanced Content Specialization or Advanced Specialized Pedagogy Areas.*

Teaching English as a Second Language Concentration

The Concentration in Teaching English as a Second Language (TESL) is designed to prepare teachers to work with K-12 learners in the public schools. Additionally, it prepares candidates to teach in adult ESL (English as a Second Language) or in international contexts. The program provides a pathway to ESL licensure for current teachers who already possess an "A" level license in another teaching discipline. This program serves the current needs of the educational community by preparing highly qualified teachers to work with diverse English Learners (ELs) in a variety of educational settings.

Core Courses (12 credit hours)

TESL 5103 - Methods in Teaching English as a Second Language (3)
TESL 5104 - Authentic Assessment (3)
TESL 5205 - Second Language Acquisition and Linguistics in K-12 Schools (3)
TESL 6204 - Multicultural Education (3)

Advanced Methods Course (3 credit hours)

TESL 6476 - Advanced Pedagogy in Teaching English as a Second Language (3)

Advanced Specialization Courses (15 credit hours)

Required Courses (12 credit hours)

MDSK 6260 - Teacher Leadership (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)
TESL 6691 - Seminar in Professional Development (3)
or MDSK 6691 - Seminar in Professional Development (3)

Elective Course (3 credit hours)

Select one of the following from the approved list. Other course substitutions may be allowed with prior approval from the program director. Students may also take an approved study abroad course as an elective option.

EDUC 6000 - Topics in Education (1 to 6) *
ENGL 6161 - Introduction to Linguistics (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
READ 6204 - Teaching Reading to English Language Learners (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)

** Students may repeat EDUC 6000 up to 6 credit hours and substitute these credit hours for courses within the Advanced Content Specialization or Advanced Specialized Pedagogy Areas.*

Curriculum Leadership Concentration

This non-licensure concentration provides an avenue for education professionals who do not wish to seek or require advanced teaching licensure to pursue a Master's Degree. These teachers include those working in alternative school setting, including but not limited to independent schools. The Curriculum Leadership concentration includes classes in education leadership and learning, design, and technology as well as courses

currently offered in existing concentrations of the program.

Note: This concentration does not lead to advanced licensure.

Core Courses (12 credit hours)
MDSK 6156 - Curriculum, Teaching, and Contemporary Issues in Education (3)
MDSK 6260 - Teacher Leadership (3)
MDSK 6691 - Seminar in Professional Development (3)
RSCH 6101 - Research Methods (3)

Equity in Education Elective Course (3 credit hours)
Select one of the following electives which focus on diversity, equity, and inclusion (subject to availability) from the list of courses below. Two additional courses may be selected as electives. Candidates are required to choose courses under consultation of their advisor.

EDUC 6000 - Topics in Education (1 to 6)
EDUC 6102 - The Person and School in Urban Society (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
TESL 6204 - Multicultural Education (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Content Elective Courses (15 credit hours)
Select up to 15 credit hours from the list of courses below (subject to availability). Candidates are required to choose courses under consultation of their advisor. A maximum of 6 credit hours from the equity electives may be applied.

ADMN 6100 - Fundamentals of Educational Leadership (3)
ADMN 6105 - Legal Aspects of Schooling (3)
EDUC 6000 - Topics in Education (1 to 6)
EDUC 6102 - The Person and School in Urban Society (3)
ELDT 5100 - Technology Integration in Education (3)
ELDT 6110 - Instructional Design (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
ENGL 6274 - Contexts and Issues in the Teaching of English (3)
MAED 6252 - Advanced Methods in Middle and Secondary Mathematics Education (3)
MDLG 6225 - Issues in Middle Grades Education (3)
MDLG 6800 - Individual Study in Middle Grades Education (1 to 6)
MDSK 6142 - Readings in Assessment, Measurement, and Student Achievement (3)
MDSK 6220 - Adolescence and Learning (2 or 3)
MDSK 6250 - Issues in 6-12 Science Education (3)
MDSK 6251 - Issues in 6-12 Mathematics Education (3)
MDSK 6254 - Issues in 6-12 Social Studies Education (3)
MDSK 6351 - Advanced Methods in Middle and Secondary Science (3)
MDSK 6354 - Advanced Methods in Middle and Secondary Social Studies (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)
SECD 6800 - Individual Study in Secondary Education (1 to 6)
TESL 6204 - Multicultural Education (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Capstone Experience
Students in all concentrations must complete a capstone experience. They complete either a comprehensive portfolio or research project, as assigned by their program advisor.

Degree Total = 30 Credit Hours

Advising
Each candidate will have an assigned advisor within the Department of Middle Grades, Secondary, and K-12 Education.

Licensure
Graduates of the M.Ed. who have an "A" license will be eligible to receive an Advanced Competency "M" license (Standard Professional 2 [SP2] Professional Educator's License) in Middle Grades (6-9), Secondary (9-12), or English as a Second Language (ESL) from the state of North Carolina in addition to their Master's Degree if they are enrolled in the aligned concentration. Candidates enrolled in the Curriculum Leadership concentration are not eligible for advanced licensure.

Note: Standard Professional 2 (SP2) Professional Educator's Licenses are intended for teachers with 3 or more years of teaching experience, and are valid for five years. Teachers who are fully licensed and "Highly Qualified" in another state who have three or more years of teaching experience in another state AND who meet NC's Praxis testing requirements OR have National Board Certification are issued the SP2 Professional Educator's license.

Committees
Candidates convene a committee of three graduate faculty members whom they select with assistance from their department advisor if a research project is required as the capstone experience. The primary role of this committee is to assess the research project. All other candidates complete the comprehensive portfolio which is guided by the course instructor for MDSK 6691 or TESL 6691.

Research Opportunities and Experiences
There are many opportunities for candidates to participate in research studies on either an independent or collaborative basis. These opportunities are available with Department faculty members, through assigned

coursework, and through the research project.

M.A.T. in Middle and Secondary Education

The Master of Arts in Teaching (M.A.T.) in Middle Grades or Secondary Education program is designed for individuals with a bachelor's degree and a Major in English, Mathematics, History, Biology, Chemistry, Earth Sciences, Physics, or a related field, or a bachelor's degree and a major relevant to one of the Career and Technical Education (CTE) concentrations (i.e., Business/IT, Marketing, Technology, and Family and Consumer Sciences).

The M.A.T. program is a 30 credit hour program composed of two phases: the Graduate Certificate phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I of the M.A.T. leads to the initial Standard Professional I teaching license in the related content area. Phase I requires 16 credit hours of coursework, including the graduate student teaching/internship experience. Upon completion of Phase I, qualified candidates may continue into Phase II upon acceptance into the program to complete the remaining requirements for the Master's degree and qualify for the advanced Standard Professional II teaching license.

All courses for both phases of the M.A.T. must be completed within 7 years. Coursework within Phase I/Graduate Certificate must be completed within 5 years.

General Requirements for Admission to the Graduate School

Please refer to admission information in the Graduate School section of this *Catalog.*

Admission Requirements for all M.A.T. (Phase II) programs

1) Completion of the Graduate Certificate in Teaching
2) A minimum graduate GPA of 3.5 in the Graduate Certificate in Teaching
3) One recommendation from a full-time faculty member who has taught you in the Graduate Certificate in Teaching program
4) A statement of purpose
5) Official transcripts
6) Apply online at gradadmissions.charlotte.edu

The admission process includes timely completion of the Application for Graduation from the Graduate Certificate program.

Students with a GPA below 3.5 in the Graduate Certificate Phase I may be considered for admission to the M.A.T. program with scores above the 30th percentile on either the GRE or Miller Analogies Test.

Degree Requirements

Phase I/Graduate Certificate (16 credit hours)

The Graduate Certificate (Phase I of the M.A.T.) is a 16 credit hour program.

Instructional Design Courses (4 credit hours)

MDSK 5204 - Equity and Education (2)
MDSK 6162 - Planning for K-12 Instruction (2)

Content Methods Course (3 credit hours)

Select the content methods course corresponding with the intended area of licensure:
ENGL 5254 - Teaching English/Communications Skills to Middle and Secondary School Learners (3)
MAED 5252 - Teaching Mathematics to Secondary School Learners (3)
MDSK 5251 - Teaching Science to Middle and Secondary School Learners (3)
MDSK 5253 - Teaching Social Studies to Middle and Secondary School Learners (3)
MDSK 5255 - Methods in Teaching Career and Technical Education (3)

Lab Course (1 credit hour)

MDSK 6162L - Instructional Design Lab (1) *(to be taken as a corequisite with MDSK 6162)*

Assessment Course (3 credit hours)

Select the assessment course section that corresponds with the intended area of licensure:
MDSK 5300 - Content Area Instruction and Assessment (3)

Adolescent Development Course (2 credit hours)

Select the adolescent development course that corresponds with the intended area of licensure:

MDLG 5130 - The Middle Grades Experience (2)
SECD 5140 - The Secondary School Experience (2)

Student Teaching (3 credit hours)

Complete the following required full-time student teaching internship:
MDSK 6470 - Graduate Student Teaching and Internship (3 to 6)

Note: The graduate-level student teaching/internship is the culminating experience in Phase I of the M.A.T., offering candidates the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Candidates are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision

of the classroom teacher and University faculty. - Residency teachers must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place upon admission to the program.

There is no required internship for Phase II of the M.A.T.

Phase II/Completion of M.A.T. (14 credit hours)

Core Courses (8 credit hours)

MDSK 6220 - Adolescence and Learning (2 or 3)
MDSK 6260 - Teacher Leadership (3)
MDSK 6691 - Seminar in Professional Development (3)

Advanced Content Specialization Courses (3 credit hours)

Select one of the following areas:

Middle Grades Education
MDLG 6225 - Issues in Middle Grades Education (3)

Secondary Education
Students select one from the following in their content area:

Mathematics
MAED 5XXX-6XXX - Mathematics Education Elective (3)
MATH 5XXX-6XXX - Mathematics Elective (3)
STAT 5XXX-6XXX - Statistics Elective (3)

English
ENGL 5XXX-6XXX - English Elective (3)
READ 5XXX-6XXX - Reading, Language, and Literacy Elective (3)
MDSK 5XXX-6XXX - Middle, Secondary, and K-12 Education Elective (3) (topics course that is content specific)

Science
BIOL 5XXX-6XXX - Biology Elective (3)
CHEM 5XXX-6XXX - Chemistry Elective (3)
ESCI 5XXX-6XXX - Earth Sciences Elective (3)
GEOG 5XXX-6XXX - Geography Elective (3)
PHYS 5XXX-6XXX - Physics Elective (3)

Social Studies
AFRS 5XXX-6XXX - Africana Studies Elective (3)
GEOG 5XXX-6XXX - Geography Elective (3)
HIST 5XXX-6XXX - History Elective (3)
MDSK 5XXX-6XXX - Middle, Secondary, and K-12 Education Elective (3) (topics course that is content specific)
POLS 5XXX-6XXX - Political Science Elective (3)
RELS 5XXX-6XXX - Religious Studies Elective (3)
WGST 5XXX-6XXX - Women's and Gender Studies Elective (3)

Career and Technical Education Concentration Course
Candidates in one of the Career and Technical Education (CTE) concentrations must select one of the following course options:

MDLG 6225 - Issues in Middle Grades Education (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Advanced Methods Course (3-4 credit hours)

Select the one related advanced methods area:
ENGL 6274 - Context and Issues in the Teaching of English (4)
MAED 6252 - Advanced Methods in Middle and Secondary Mathematics (3)
MDSK 6351 - Advanced Methods in Middle and Secondary Science (3)
MDSK 6354 - Advanced Methods in Middle and Secondary Social Studies (3)
MDSK 6355 - Advanced Methods of Teaching Career and Technical Education (3)

Capstone Requirement

The capstone experience for the M.A.T. is fulfilled by completing a Comprehensive Portfolio.

Degree Total = 30 Credit Hours

Clinical Field Experiences

Most courses require candidates to develop their knowledge, skills, and dispositions in public school/agency settings. All candidates are expected to complete clinical experiences in at least two significantly different settings. Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, candidates apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. These structured experiences can take place in multiple settings such as neighboring schools or districts, day care centers and after-school programs, alternate youth centers, or in the schools and classrooms in which the candidates work.

Clinical experiences for Residency teachers may be approved in significantly different classrooms within their school of employment. Alternative settings must be approved by the instructor.

Advising

All candidates are assigned an advisor upon formal admission to the program. Candidates should consult with their advisors at least once each semester.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, candidates will be recommended for the North Carolina initial Standard Professional I teaching license. For this initial license, candidates are required to complete an electronic licensure portfolio that is created during coursework and student teaching. Upon successful completion of Phase II, candidates will be recommended for the North Carolina advanced Standard Professional II teaching license. For the advanced license, candidates are required to complete an advanced electronic licensure portfolio during coursework.

Graduate Certificate in Teaching: Middle and Secondary Education

The Graduate Certificate in Teaching - Middle Grades and Secondary Education is a 16 credit hour program, including the graduate student teaching/internship experience plus any background content courses needed, designed for students who hold a bachelor's degree. Upon successful completion of the Graduate Certificate, students are eligible for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. The program is designed for current (Residency Teachers) and aspiring middle and secondary school teachers of math, science, English language arts, social studies, and Career and Technical Education fields (Business, Marketing, Technology, and Family and Consumer Sciences).

The required courses for the Graduate Certificate are identical to Phase I of the M.A.T. Upon completion of the Graduate Certificate, qualified students have the option of continuing into Phase II to complete the M.A.T. Admission to the Graduate Certificate is separate and distinct from admission to a graduate degree program and not an indication of automatic admission to the M.A.T. degree program. For more information on this option, refer to the M.A.T. in Middle Grades and Secondary Education.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to admission information in the Graduate School section of this Catalog.

Admission Requirements for the Graduate Certificate in Teaching program

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A minimum undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) One of the following:
   a) Hold a relevant undergraduate degree
   b) Obtain or already possess 24 credit hours of coursework in the content area for which licensure is sought
   c) Passing scores on the related PRAXIS II Subject Assessment
4) Three recommendations from persons knowledgeable of the candidate's interaction with children or youth
5) A statement of purpose
6) Clear criminal background check
7) Apply online at graduateschool.charlotte.edu

Certificate Requirements

Concentrations

Select one of the following concentrations:

Middle Grades English Language Arts Concentration

ENGL 5254 - Teaching English/Communications Skills to Middle and Secondary School Learners (3)
MDLG 5130 - The Middle Grades Experience (2)
MDSK 5204 - Equity and Education (2)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Middle Grades Mathematics Concentration

MAED 5252 - Teaching Mathematics to Secondary School Learners (3)
MDLG 5130 - The Middle Grades Experience (2)
MDSK 5204 - Equity and Education (2)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Middle Grades Science Concentration

MDLG 5130 - The Middle Grades Experience (2)
MDSK 5204 - Equity and Education (2)
MDSK 5251 - Teaching Science to Middle and Secondary School Learners (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Middle Grades Social Studies Concentration

MDLG 5130 - The Middle Grades Experience (2)
MDSK 5204 - Equity and Education (2)
MDSK 5253 - Teaching Social Studies to Middle and Secondary School Learners (3)

MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Secondary English Language Arts Concentration
ENGL 5254 - Teaching English/Communications Skills to Middle and Secondary School Learners (3)
MDSK 5204 - Equity and Education (2)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
SECD 5140 - The Secondary School Experience (2)

Secondary Mathematics Concentration
MAED 5252 - Teaching Mathematics to Secondary School Learners (3)
MDSK 5204 - Equity and Education (2)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
SECD 5140 - The Secondary School Experience (2)

Secondary Science Concentration
MDSK 5204 - Equity and Education (2)
MDSK 5251 - Teaching Science to Middle and Secondary School Learners (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
SECD 5140 - The Secondary School Experience (2)

Secondary Social Studies Concentration
MDSK 5204 - Equity and Education (2)
MDSK 5253 - Teaching Social Studies to Middle and Secondary School Learners (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
SECD 5140 - The Secondary School Experience (2)

Career and Technical Education Business Concentration
For candidates seeking 6-12 CTE licensure in Business. CTE candidates select only one of the two offered adolescent development courses listed below: MDLG 5130 (for candidates wishing to teach at the middle school level) or SECD 5140 (for candidates wishing to teach at the secondary school level).

MDSK 5204 - Equity and Education (2)
MDSK 5255 - Methods in Teaching Career and Technical Education (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
MDLG 5130 - The Middle Grades Experience (2)
or SECD 5140 - The Secondary School Experience (2)

Career and Technical Education Family and Consumer Sciences Concentration
For candidates seeking CTE licensure in Family and Consumer Sciences. CTE candidates select only one of the two offered adolescent development courses listed below: MDLG 5130 (for candidates wishing to teach at the middle school level) or SECD 5140 (for candidates wishing to teach at the secondary school level).

MDSK 5204 - Equity and Education (2)
MDSK 5255 - Methods in Teaching Career and Technical Education (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
MDLG 5130 - The Middle Grades Experience (2)
or SECD 5140 - The Secondary School Experience (2)

Career and Technical Education Marketing Concentration
For candidates seeking 6-12 CTE licensure in Marketing. CTE candidates select only one of the two offered adolescent development courses listed below: MDLG 5130 (for candidates wishing to teach at the middle school level) or SECD 5140 (for candidates wishing to teach at the secondary school level).

MDSK 5204 - Equity and Education (2)
MDSK 5255 - Methods in Teaching Career and Technical Education (3)
MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
MDLG 5130 - The Middle Grades Experience (2)
or SECD 5140 - The Secondary School Experience (2)

Career and Technical Education Technology Concentration
For candidates seeking 6-12 CTE licensure in Technology. CTE candidates select only one of the two offered adolescent development courses listed below: MDLG 5130 (for candidates wishing to teach at the middle school level) or SECD 5140 (for candidates wishing to teach at the secondary school level).

MDSK 5204 - Equity and Education (2)
MDSK 5255 - Methods in Teaching Career and Technical Education (3)

MDSK 5300 - Content Area Instruction and Assessment (3)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
MDLG 5130 - The Middle Grades Experience (2)
or SECD 5140 - The Secondary School Experience (2)

Internship/Student Teaching

The graduate-level student teaching/internship is the culminating experience for all concentrations in the Graduate Certificate program, offering candidates the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Candidates are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and University faculty. Residency teachers may complete the internship in their own classroom, but must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place upon admission to the program.

MDSK 6470 - Graduate Student Teaching and Internship (3 to 6)

Certificate Total = 16 Credit Hours

Advising

All candidates are assigned an advisor upon formal admission to the program. Candidates should consult with their advisors at least once each semester.

Clinical Field Experiences

Most courses require candidates to develop their knowledge, skills, and dispositions in public school/agency settings. All candidates are expected to complete clinical experiences in at least two significantly different settings. Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, candidates apply theories and understandings gained in coursework, analyze 6-12 student learning, and develop the ability to positively impact all learners. Arrangements for the clinical field experience are made through the Office of School & Community Partnerships.

Residency teachers may complete clinical requirements in their own classroom and school. Alternative settings must be approved by the instructor. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, candidates will be recommended for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. For this initial license, candidates are required to complete an electronic licensure portfolio that is created during coursework and student teaching.

Graduate Certificate in Teaching: Art Education

The Graduate Certificate in Teaching for Art Education is an 16 credit hour program designed for candidates who hold a bachelor's degree and a major in Visual Arts. It is offered by the College of Education in collaboration with the College of Arts + Architecture. The Colleges collaborate to provide arts professionals an alternative pathway to a teaching certificate. Upon successful completion of the Graduate Certificate, students are eligible for the North Carolina initial Standard Professional I teaching license.

All courses for the Graduate Certificate in Teaching must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to general information provided in The Graduate School section of this Catalog.

Graduate Certificate Admission Requirements

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of your interaction with children or youth
4) Statement of purpose
5) Clear criminal background check
6) Apply online at gradadmissions.charlotte.edu
7) Submission of digital portfolio

Certificate Requirements

Core Courses (13 credit hours)

ARTE 5121 - Teaching Art to Elementary Students (3)
ARTE 5122 - Teaching Art to Secondary Students (3)
MDSK 6162 - Planning for K-12 Instruction (2)
TESL 6204 - Multicultural Education (3)
MDLG 5130 - The Middle Grades Experience (2)
or SECD 5140 - The Secondary School Experience (2)

Internship/Student Teaching (3 credit hours)

The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate in Teaching program, offering candidates the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Candidates are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and university faculty. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place at least one semester before student teaching.

MDSK 6470 Graduate Student Teaching and Internship (3 to 6)

Content Background Requirements

The applicant's undergraduate coursework (and professional experiences) will be reviewed to determine if the applicant's background is sufficient to meet current standards for art teachers. If deficiencies are identified, a plan of study for additional coursework will be provided.

Certificate Total = 16 Credit Hours

Advising

All candidates are assigned an advisor upon formal admission to the program. Candidates should consult with their advisors at least once each semester.

Clinical Field Experiences

Most courses require candidates to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all children learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, candidates apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. All candidates are expected to complete clinical experiences in at least three significantly different school settings (the graduate student teaching placement may serve as one of the settings).

Candidates who are Residency Teachers or teacher assistants must move beyond their own classrooms when completing clinical experiences. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators to complete these requirements.

Licensure

Upon successful completion of the Graduate Certificate, candidates will be recommended for the North Carolina initial Standard Professional I teaching license. For this license, candidates are required to complete an electronic licensure portfolio that is created during coursework and student teaching. Earning a passing score on the required PRAXIS II test is also mandatory for the licensure recommendation. Additional information on this test is available on www.ets.org/praxis.

Graduate Certificate in Common Core Instruction

The Graduate Certificate in Common Core Instruction equips practicing teachers with enhanced content and pedagogical skills through sustained professional development (PD) that supports the language and content demands of the Common Core State Standards in both English/Language Arts (ELA) and Mathematics. This certificate program requires 12 credit hours.

General Requirements for Admission to the Graduate School

Please refer to admission information in the Graduate School section of this Catalog.

Admission Requirements for the Graduate Certificate in Teaching program

- K-12 Teaching License
- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- GPA of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school).
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college coursework attempted

Certificate Requirements

Required Courses (12 credit hours)

ELED 6311 - Number Systems and Operations: K-5 Mathematical Tasks (3)
READ 5255 - Integrating Reading and Writing in the Content Areas (3)
TESL 5103 - Methods in Teaching English as a Second Language (3)
TESL 5104 - Authentic Assessment (3)

Certificate Total = 12 Credit Hours

Grade Requirements
To successfully complete the certificate, program candidates must pass all 4 courses with no more than two grades of C.

Graduate Certificate in National Board Certification

The Graduate Certificate in National Board Certification is a 12 credit hour program designed for those interested in pursuing National Board Certification. The required courses are closely aligned with the four components required of National Board Certification. All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School
Please refer to admission information in the Graduate School section.

Admission Requirements for the Graduate Certificate in Teaching program
- Undergraduate degree from a college or university accredited by an accepted accrediting body
- Minimum undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
- Three recommendations from persons knowledgeable of your interaction with children or youth
- Statement of purpose
- Clear criminal background check
- Apply online at gradadmissions.charlotte.edu

Certificate Requirements
Required Courses (12 credit hours)

EDUC 6310 - Contemporary Issues and Practices of National Board Certification (3)

EDUC 6320 - Planning and Assessing Effective Instruction for National Board Certification (3)

EDUC 6330 - Teaching Practice and Learning Environment for National Board Certification (3)

EDUC 6340 - Becoming an Effective and Reflective Practitioner for National Board Certification (3)

Certificate Total = 12 Credit Hours

Clinical Field Experiences
Candidates in the Graduate Certificate program participate in field experiences that require them to apply coursework in their classroom settings, analyze student learning, and reflect on their practice in the context of theories on teaching and learning. These experiences broaden their ability to help all students learn through portfolio exercises that require analysis of student work and reflection on instruction. These structured field experiences are designed to take place in multiple settings within the candidates' school community or districts, after-school programs, alternate youth centers, or in the schools and classrooms in which the candidates work.

Advising
All candidates are assigned an advisor upon formal admission to the program. Candidates should consult with their advisors at least once each semester.

EDUCATIONAL LEADERSHIP AND SCHOOL ADMINISTRATION

- Ed.D. in Educational Leadership
  - Higher Education
  - Learning, Design, and Technology
  - P-12 Superintendency
- M.Ed. in Educational Leadership
- Master of School Administration (MSA)
- Post-Master's Certificate in School Administration
- Post-Master's Certificate in University and College Teaching

Department of Educational Leadership
edld.charlotte.edu

Ed.D. in Educational Leadership

The Ed.D. in Educational Leadership is designed to prepare educational administrators who can assume mid-level and senior-level leadership positions in public school and post-secondary settings. The program includes three concentrations: (1) Higher Education, (2) Learning, Design, and Technology, and (3) P-12 Superintendency.

Graduates of the program are prepared to:
1) Exhibit a broad understanding of their roles as educational leaders in the organizations they serve
2) Demonstrate leadership competencies and skills necessary to accomplish the goals of complex organizations
3) Interact successfully with the numerous institutions and interests that influence their organizations
4) Understand theoretical concepts that undergird organizational theory and behavior, leadership, social psychology, policy, educational administration, and research
5) Address issues that face educational leaders, including resource acquisition and management; policy development and analysis; program management; community relations; curriculum development; and personnel selection, development, and evaluation

Degree Requirements
The Ed.D. program consists of a minimum of 48 credit hours beyond the master's degree. Students select one of three concentrations.

Higher Education Concentration

The Concentration in Higher Education is designed for those interested in careers as senior-level leaders in post-secondary settings, including higher education, adult education, and research. To ensure the effectiveness and competence of individuals in such positions, coursework within the program is comprised of foundational work in educational leadership, research, and higher education with further specialization available in adult education or educational research. Prospective students should already have a Master's degree in an appropriate and related field. They are neither required to hold North Carolina P-12 licensure nor will any license or certificate be recommended upon graduation.

Foundation Courses (9 credit hours)
ADMN 8110 - Organization Theory and Behavior (3)
ADMN 8181 - Equity and Social Justice in Adult Education (3)
ADMN 8610 - Interdisciplinary Seminar (3)

Concentration Courses (15 credit hours)
Select from the following:
ADMN 8000 - Topics in Educational Leadership (1 to 6)
ADMN 8170 - Introduction to the Community College (3)
ADMN 8171 - The American College Student (3)
ADMN 8172 - Higher Education in the United States (3)
ADMN 8173 - Legal Issues in Higher Education (3)
ADMN 8174 - Higher Education Finance and Budgeting (3)
ADMN 8175 - Non-Traditional Approaches to Higher Education (3)
ADMN 8176 - Women in Higher Education (3)
ADMN 8177 - Student Affairs in Higher Education (3)
ADMN 8178 - Higher Education Policy and Governance (3)
ADMN 8179 - Contemporary Issues in Higher Education (3)
ADMN 8180 - Teaching Strategies for Adults in a Diverse Society (3)

Research Courses (15 credit hours)
RSCH 8110 - Descriptive and Inferential Statistics (3)
or RSCH 8111 - Qualitative Research (3)
RSCH 8120 - Advanced Statistics (3)
or RSCH 8121 - Qualitative Data Collection and Analysis (3)
RSCH 8210 - Applied Educational Research (3)
RSCH 8196 - Program Evaluation Methods (3)
RSCH 8890 - Special Topics in Research (3)

Elective Courses (3 credit hours)
Select from 8000-level courses geared toward the doctoral dissertation and/or professional pathway. Elective courses include: higher education; adult education; educational research; learning, design, and technology; and related courses.

Select one of the following:
ADMN 8000-level courses (3)
CUSU 8126 - National and International Developments in the Community College (3)
CUSU 8127 - Comparative Higher Education (3)
ELDT 8000-level courses (3)
RSCH 8000-level courses (3)
Other 8000-level courses as approved by the advisor (3)

Proposal Design Course (3 credit hours)
Students take this course only after all coursework is completed or during the final semester of coursework.

ADMN 8699 - Dissertation Design Seminar (3)*

Dissertation Course (6 credit hours)
Students must take a minimum of six credit hours of ADMN 8999 only after all other coursework in the program is completed, beginning with the semester following ADMN 8699. Students must maintain continuous enrollment in ADMN 8999 until degree completion and must be enrolled during the semester in which they graduate. Failure to maintain continuous enrollment in ADMN 8999 will result in dismissal from the program.

ADMN 8999 - Dissertation (3)

Students must complete and defend an applied dissertation focused on a specific problem or question relevant to their specialization. Defense of their dissertation is conducted in a final oral examination that is open to members of the University community.

Degree Total = 48 Credit Hours

Learning, Design, and Technology Concentration

The Concentration in Learning, Design, and Technology is designed for those interested in careers as senior-level leaders in Learning, Design, and Technology positions in higher education, K-12, corporate, government or military settings. To ensure the effectiveness and competence of individuals in such positions, coursework within the program is comprised of foundational work in educational leadership, research, and learning, design, and technology specialization courses. Prospective students should already have a Master's degree in an appropriate and related field. They are not required to hold North Carolina P-12 licensure.

Foundation Courses (9 credit hours)
ADMN 8110 - Organizational Theory and Behavior (3)
ADMN 8181 - Equity and Social Justice in Adult Education (3)
ADMN 8610 - Interdisciplinary Seminar (3)

Concentration Courses (15 credit hours)
Required Concentration Courses
ADMN 8695 - Advanced Seminar in Teaching and Learning (3)
ELDT 8102 - Research in Learning, Design, and Technology (3)

Elective Concentration Courses
Select three of the following:
ELDT 8000 - Topics in Learning, Design, and Technology (1 to 6)
ELDT 8100 - Foundations of Learning, Design, and Technology (3)
ELDT 8110 - Instructional Design (3)
ELDT 8120 - Current Trends in Learning, Design, and Technology (3)
ELDT 8121 - Advanced Instructional Design (3)
ELDT 8130 - Instructional Multimedia Development (3)
ELDT 8135 - Learning Media, Resources and Technology (3)
ELDT 8150 - Design, Development, and Evaluation of Online Learning Systems (3)
ELDT 8160 - Designing Learning Systems with Simulation and Game Technology (3)
ELDT 8170 - Human Performance Technology (3)
ADMN 8125 - Doctoral Seminar in Instruction (3)
ADMN 8171 - The American College Student (3)
ADMN 8660 - Instructional Leadership Seminar (3)

Research Courses (15 credit hours)
RSCH 8110 - Descriptive and Inferential Statistics (3)
or RSCH 8111 - Qualitative Research Methods (3)
RSCH 8120 - Advanced Statistics (3)
or RSCH 8121 - Qualitative Data Collection and Analysis (3)
RSCH 8196 - Program Evaluation Methods (3)
RSCH 8210 - Applied Research Methods (3)
RSCH 8890 - Special Topics in Research (3)

Proposal Design Course (3 credit hours)
Students may take the following course only after all coursework is completed or during the final semester of coursework:

ADMN 8699 - Dissertation Proposal Seminar (3)

Dissertation Course (6 credit hours)
Students must take a minimum of six credit hours of ADMN 8999 only after all other coursework in the program is completed, beginning with the semester following ADMN 8699. Students must maintain continuous enrollment in ADMN 8999 until degree completion and must be enrolled during the semester in which they graduate. Failure to maintain continuous enrollment in ADMN 8999 will result in dismissal from the program.

Students must complete and defend an applied dissertation focused on a specific problem or question relevant to their specialization. Defense of their dissertation

is conducted in a final oral examination that is open to members of the University community.

ADMN 8999 - Dissertation Research (3)

Degree Total = 48 Credit Hours

P-12 Superintendency Concentration

The Concentration in P-12 Superintendency is designed to serve the needs of those interested in the study of issues regarding the administration of P-12 public and private educational institutions. These students pursue careers as superintendents and senior-level administrators. In addition to the program requirements regarding leadership experiences, prospective students must hold a Master of School Administration, Master of Education in Curriculum Supervision, Master of Education in Instructional Technology, or a comparable degree. These students must already have a valid "M" level certificate in an appropriate field. Students in the Concentration in P-12 Superintendency are eligible to be recommended for a School Administrator-Superintendent license at the doctoral level upon successful completion of the program. A Concentration in P-12 Superintendency may be chosen by working with the advisor and selecting the appropriate courses and experiences.

Foundation Courses (9 credit hours)

ADMN 8110 - Organization Theory and Behavior (3)
ADMN 8181 - Equity and Social Justice in Adult Education (3)
ADMN 8610 - Interdisciplinary Seminar (3)

Concentration Courses (18 credit hours)

ADMN 8120 - Rethinking Education Reform: Law, Policy, and Public Schools (3)
ADMN 8125 - Doctoral Seminar in Instruction (3)
ADMN 8140 - School Finance (3)
ADMN 8150 - Human Resources and Development (3)
ADMN 8410 - Advanced Internship in Educational Leadership Part 1 (3)
ADMN 8420 - Advanced Internship in Educational Leadership Part 2 (3)

Research Courses (12 credit hours)

RSCH 8110 - Descriptive and Inferential Statistics (3) or RSCH 8111 - Qualitative Research (3)
RSCH 8196 - Program Evaluation Methods (3)
RSCH 8210 - Applied Educational Research (3)
RSCH 8890 - Special Topics in Research (3)

Proposal Design Course (3 credit hours)

ADMN 8699 - Dissertation Design Seminar (3)

Dissertation Course (6 credit hours)

Students must take a minimum of six credit hours of ADMN 8999 only after all other coursework in the program is completed, beginning with the semester following ADMN 8699. Students must maintain continuous enrollment in ADMN 8999 until degree completion and must be enrolled during the semester in which they graduate. Failure to maintain continuous enrollment in ADMN 8999 will result in dismissal from the program.

ADMN 8999 - Dissertation (3)

Students must complete and defend an applied dissertation focused on a specific problem or question relevant to their specialization. Defense of their dissertation is conducted in a final oral examination that is open to members of the University community.

Internship

All P-12 Superintendency concentration students seeking licensure are required to complete an internship in a P-12 school district. The internship is based upon identified objectives and organizational areas within the school system of the internship assignment. Students are also required to complete electronic key evidences related to vision, staffing, resources, instruction/learning, and governance.

Degree Total = 48 Credit Hours

Advising

Doctoral students have the benefit of three phases of advising as they pursue their degree.

Phase I

Higher Education Concentration

The doctoral coordinator or an assigned faculty member serves as the advisor when students enter the program. During this phase, the advisor plans a course of study with students during the initial stages of the program. A Program Planning Sheet is used to document tentative plans for projected coursework. The planning sheet should be kept by the student and a copy should be provided to the advisor.

Learning, Design, and Technology Concentration

Doctoral students have the benefit of two phases of advising as they pursue their degree. The doctoral coordinator or an assigned faculty member serves as the advisor when students enter the program. During this phase, the advisor plans a course of study with students during the initial stages of the program. Degree works is used to guide the advising process. A program planning sheet is used to document tentative plans for projected coursework. This advisor serves as a guide through the completion of the coursework. This advisor also serves as

the coordinator of the process to complete the Portfolio Requirements. This advisor, in consultation of the student, has the responsibility for creating a "portfolio committee" that is made up of the faculty who prepares and evaluates the written and oral comprehensive portfolio requirements. (See Portfolio requirements.) This advisor also helps the student identify faculty whose research interests and expertise are congruent with the student's probable area of inquiry for the dissertation

.

P-12 Superintendency Concentration

Students follow the cohort model. All coursework, electronic evidences, formation of dissertation committee, proposal defenses, internships, and dissertation defense are scheduled. The Graduate Program Director advises all students.

Phase II

Higher Education Concentration

By the end of the first year of the program, students select a "program advisor" to serve as a guide through the completion of the coursework. This person also serves as the coordinator of the process to complete the Qualifying Examination. This advisor also helps the student identify faculty whose research interests and expertise are congruent with the student's probable area of inquiry for the dissertation. This advisor, in consultation of the student, has the responsibility for creating a "doctoral committee" that is made up of the faculty who prepares and evaluates the written and oral comprehensive qualifying exam. *(See Qualifying Examination section.)*

The responsibility of the doctoral committee members includes:

1) Approval of the student's course of study
2) Approval of the dissertation proposal
3) Evaluation of the final dissertation and oral defense

Learning, Design, and Technology Concentration

Upon successful completion of the portfolio requirements, students are recommended for admission to candidacy. They may then select a dissertation advisor and a dissertation committee and complete a "Change of Advisor Form," if needed. These committee members are appointed to serve on the committee with mutual consent between the student and each faculty member. The committee consists of four members of the Graduate Faculty: the Department of Educational Leadership Chairperson, two other members from the department, and one member appointed by the Graduate School from outside the Department of Educational Leadership.

The purpose of this process is to provide students with an opportunity to develop a direct working relationship with several faculty members. At the same time, it provides an individualized and personalized approach to the advising process. For example, some students may choose to keep the same faculty member to serve as both the program advisor and the dissertation advisor. Likewise, the doctoral committee and the dissertation committee could include some or all of the same faculty.

P-12 Superintendency Concentration

Students follow the cohort model course offering. They select a research topic and dissertation chair within the first year of the program.

Phase III

Higher Education Concentration

Upon successful completion of the Qualifying Examinations, students are recommended for admission to candidacy. They may then select a dissertation advisor and a dissertation committee and complete a "Change of Advisor Form," if needed. These committee members are appointed to serve on the committee with mutual consent between the student and each faculty member. The committee consists of four members of the Graduate Faculty: the Department of Educational Leadership Chairperson, two other members from the department, and one member appointed by the Graduate School from outside the Department of Educational Leadership.

The purpose of this process is to provide students with an opportunity to develop a direct working relationship with several faculty members. At the same time, it provides an individualized and personalized approach to the advising process. For example, some students may choose to keep the same faculty member to serve as both the program advisor and the dissertation advisor. Likewise, the doctoral committee and the dissertation committee could include some or all of the same faculty.

Qualifying Examination/Portfolio Requirement/Key Electronic Evidences

Higher Education Concentration

Students are required to successfully pass a written and oral examination. The examination is based upon the core areas of the respective specializations.

Learning, Design and Technology Concentration

In addition to coursework and the dissertation, students must complete a portfolio of achievements related to the focus areas of learning, design, and technology. This portfolio must receive satisfactory ratings from the Portfolio Review Committee and serves as the qualifying examination. Example products in this portfolio include: 1) an applied instructional design project, 2) research based paper, and 3) a research project proposal. Students present this portfolio in an oral presentation to the Portfolio Review Committee. Students have to successfully submit and present the portfolio before they can enroll in the dissertation proposal seminar course.

P-12 Superintendency Concentration
Students must score proficient on five electronic key evidences (Vision, Staffing, Resources, Instruction/Learning, and Governance) required for the School Administrator - Superintendent license.

Application for Degree and Application for Candidacy

Students may submit an Application for Degree and an Application for Candidacy during the semester in which they successfully defend their dissertation proposal. Adherence to Graduate School deadlines is expected. Degree requirements are completed when a student successfully defends the dissertation and files the final copy of the dissertation in the Graduate School.

M.Ed. in Educational Leadership

The M.Ed. in Educational Leadership is designed to prepare highly competent leaders for the P-20 education environment, particularly school systems, community colleges, and universities. To achieve its objectives, the program is designed to attract high-quality students and help them develop specific competencies to contribute to a variety of educational settings.

Today, educational leaders in the P-12 and higher education settings must be able to elicit support and create educational environments that foster creativity, change, and innovation that will educate diverse populations in American education. To meet this challenge, the M.Ed. program focuses on leadership development.

The M.Ed. program provides for 30 credit hours of classroom study. The program faculty work with individual students to design a course-taking strategy applicable to individual goals to best leverage the available curriculum for professional pursuits.

Program Objectives

The major educational objectives of the program are to develop educational leaders who have advanced knowledge and skills by:

1) Encouraging participants in the program to self-direct their personal and professional growth as educators by:
   a) Taking responsibility for their own learning;
   b) Initiating professional inquiry through conversations with colleagues;
   c) Critically reading professional literature;
   d) Participating in personal and professional development opportunities; and
   e) Setting high expectations for their professional performance.
2) Guiding participants to promote in P-20 students and education professionals the skills to respond effectively to student differences by:
   a) Developing and advanced understanding of human development;
   b) Expecting and respecting diversity among individuals in educational settings;
   c) Promoting understanding and respect for all members of the educational community;
   d) Helping students, stakeholders, and colleagues develop a global perspective; and
   e) Applying their knowledge at all levels of interaction with students by creating educational environments where all individuals feel welcome as leaders and successful learners.
3) Improving educational practice through self-refection, self-evaluation, and applied research by:
   a) Engaging in study that leads to continuous improvement of educational leadership;
   b) Actively investigating and solving educational problems through data gathering and assessment;
   c) Continuously monitoring the learning problems and successes of each learner;
   d) Making appropriate adjustments in practice based on analysis of data.
4) Serving as educational leaders by:
   a) Actively participating as leaders in areas in which they can contribute to solving educational problems: schools, school districts, community colleges, universities, and affiliated organizations;
   b) Taking responsibility for sharing in decision-making relative to institutional issues;
   c) Readily asking for and sharing successful instructional approaches and solutions with colleagues, supervisors, and educational leaders; and
   d) Providing mentoring for students and colleagues.

Admission Requirements

In order to be considered for admission to the M.Ed. program, applicants are expected to submit an online application through the Graduate School and meet the following requirements:

1) Bachelor's degree (or its U.S. equivalent) from a college or university accredited by an accepted accrediting body.
2) GPA 3.0 (on a 4.0 scale). If an applicant has earned or attempted a post-baccalaureate degree (i.e., master's, doctoral, or other), grades in that program will also be taken into consideration.
3) A Statement of Purpose (essay) submitted online as part of the application submission process.
4) At least three recommendation forms from persons familiar with your personal, academic and/or professional qualifications. These Recommendations

are submitted directly from your recommender via the online application system.
5) Unofficial transcripts of all academic work attempted beyond high (secondary) school can be used for admission review. An official (officially certified) final transcript must be submitted if an applicant is offered admission. International transcripts provided in a language other than English should be uploaded, but a translated version should be uploaded as well.
6) A description of previous relevant employment.
7) Reports of GRE/GMAT test scores (optional).
8) For non-native English language holders: official English Language Proficiency Scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS). Required is either a minimum score of 83 on the Internet-based TOEFL, or a minimum overall band score of 6.5 on the IELTS.

Priority application deadlines are March 1 for Fall admission and October 1 for Spring admission.

Degree Requirements

The M.Ed. in Educational Leadership program requires 30 credit hours, including 9 credit hours of professional education core courses, 15 credit hours of coursework in educational leadership, and 6 credit hours of elective courses. Students are encouraged to work with advisors to select courses relevant to their professional interests (P-12 or Higher Education). M.Ed. completers must successfully prepare an electronic portfolio housing appropriate artifacts and evidences under the direction of program faculty.

Core Courses (9 credit hours)

ADMN 6100 - Fundamentals of Educational Leadership (3)
ADMN 6101 - Perspectives on Adult Learning Theory (3)
RSCH 6101 - Research Methods (3)

Educational Administration and Leadership Courses (15 credit hours)

Select from the following:
ADMN 6000 - Topics in Educational Administration (1 to 6)
ADMN 6105 - Legal Aspects of Schooling (3)
ADMN 6120 - Instructional Leadership (3)
ADMN 6130 - Supervision of Instruction (3)
ADMN 6140 - Curriculum Leadership (3)
ADMN 6170 - Introduction to the Community College (3)
ADMN 6171 - The American College Student (3)
ADMN 6172 - Higher Education in the United States (3)
ADMN 6173 - Legal Issues in Higher Education (3)
ADMN 6174 - Higher Education Finance and Budgeting (3)
ADMN 6175 - Non-Traditional Approaches to Higher Education (3)
ADMN 6176 - Women in Higher Education (3)
ADMN 6177 - Student Affairs in Higher Education (3)
ADMN 6178 - Higher Education Policy and Governance (3)
ADMN 6179 - Contemporary Issues in Higher Education (3)
ADMN 6180 - Teaching Strategies for Adults in a Diverse Society (3)
ELDT 5100 - Technology Integration in Education (3)
RSCH 7196 - Program Evaluation Methods (3)

Elective Courses (6 credit hours)

Select from the following with input from the advisor. - Courses from other departments may be selected with advisor and department approval.

ADMN 6430 - Internship and Professional Development in Higher Education (3)
ADMN 6XXX - Educational Leadership/School Administration Elective Course (3)
ELDT 6XXX - Education: Learning, Design, and Technology Elective Course (3)
RSCH 6XXX - Educational Research, Measurement, and Evaluation Elective Course (3)

Degree Total = 30 Credit Hours

Master of School Administration (MSA)

The mission of the Master of School Administration (M.S.A.) program is to prepare innovative, collaborative, effective, and reflective leaders who are prepared to develop school environments that ensure equitable and quality learning opportunities for a rapidly changing and increasingly diverse population and that focus on improving the learning for all students in the 21st century. Program graduates qualify for a PreK-12, Level 1 School Administrator's license (Principal).

Program Objectives

Program objectives are aligned with the approved national standards of the Educational Leaders Constituent Consortium, the North Carolina Department of Public Instruction, the National Council for Accrediting Teacher Education, and the State Board of Education's Standards for School Executives. In particular, there are six basic standards that serve as core curriculum components:

1) Visioning for school improvement
2) Creating a positive school culture, providing an effective instructional program, and designing comprehensive professional growth plans
3) Managing the organization
4) Collaborating with families and community, responding to diverse interests and needs
5) Acting with integrity, fairly, and equitably
6) Interacting and influencing the larger political, social, economic, legal, and cultural context

Admission Requirements

In addition to the general requirements for admission to the Graduate School, applicants must:

- Have a minimum of three years of successful teaching or other professional education experience
- Hold a Class A North Carolina educator license or equivalent
- Submit a 1-2 page personal statement that addresses professional experiences, future goals, and an understanding that school administrators must possess a comprehensive conceptual, pedagogical, and reflective knowledge base
- Submit a complete résumé showing evidence of leadership
- Submit a copy of the educator license
- Submit three letters of recommendation from school administrators (must include principal) who can attest to your potential success as a school principal
- Submit GRE or GMAT test scores *(optional)*

Application deadline is January 1 for applicants applying to the North Carolina Principal Fellows Program. Application deadline is April 1 for enrollment in the master's degree program and the graduate certificate program.

Admission decisions are based on an analysis of applicant profiles made by program faculty and clinical instructors. Applicants with the highest profile rankings are invited to participate in interviews. Program faculty, clinical faculty, school district central office personnel, acting principals/assistant principals, and program graduates serve on interview teams. These interviews are designed to provide the applicant an opportunity to show evidence of academic strengths, leadership potential, and personal characteristics. After the interview, the applicant will provide a writing sample from a given prompt.

The Master of School Administration Program faculty is committed to achieving diversity among the students admitted in each year's cohort group. The Graduate School will notify applicants of their admission status.

Degree Requirements

The M.S.A. program requires a total of 36 credit hours in a combination of courses in educational leadership, research, technology, curriculum, and instruction. All students must complete the required academic year-long internship under the direction of a principal-mentor and a University supervisor. The internship challenges students to demonstrate a thorough and well-integrated understanding of the basic principles, research findings, and theories covered in their coursework and apply these to educational practice and leadership situations.

ADMN 6100 - Fundamentals of Educational Leadership (3)
ADMN 6105 - Legal Aspects of Schooling (3)
ADMN 6110 - School Leadership and Management (3)
ADMN 6120 - Instructional Leadership (3)
ADMN 6130 - Supervision of Instruction (3)
ADMN 6161 - The Principalship (3)
ADMN 6410 - Internship and Seminar Part I (3)
ADMN 6420 - Internship and Seminar Part II (3)
ADMN 6490 - Internship and Seminar: Administration(3)
ADMN 6491 - Internship and Seminar: Supervision (3)
ELDT 5100 - Technology Integration in Education (3)
RSCH 6101 - Research Methods (3)

Degree Total = 36 Credit Hours

Capstone Experiences

The year-long internship requires the productive application of knowledge, skills, and dispositions, to the problems of practice. The experience provides a multitude of opportunities for the intern to progressively develop administrative competence. Interns are guided through their experience by their school-site mentor and University clinical supervisor.

Additionally, the M.S.A. and the graduate certificate program completers seeking a North Carolina principal level I license must successfully prepare an electronic portfolio housing appropriate artifacts and evidences demonstrating their proficiency in all seven standards for school executives. As of 2010, candidates seeking a North Carolina Principal's license will no longer take the SLLA (School Leaders Licensure Assessment) from ETS. The assessment to determine licensure has been replaced with the E-Portfolio.

Principal Fellows

Each year a limited number of scholarship/loans for persons seeking an M.S.A. as full-time students are available from the North Carolina Principal Fellows Program (www.ncpfp.org). The program is funded by the North Carolina General Assembly to help highly qualified persons study school administration on a full-time basis.

Post-Master's Certificate in School Administration

Students seeking to "add-on" the *Certificate in School Administration* to a previous master's degree must complete 21 credit hours, of which a portion is a supervised year-long internship.

Admission Requirements

To be eligible and to apply for this program, applicants must:

- Hold a master's degree from a college or university

accredited by an accepted accrediting body
- Have a cumulative grade point average of at least 3.2 in all previously completed graduate degree coursework
- Have three years of successful teaching experience or other professional education experience
- Submit a complete résumé
- Submit a valid NC educator license or equivalent
- Submit three letters of reference from current or past supervisors (must include principal) that document leadership and administrative experiences and potential for success as a site-based school administrator
- Submit a 1-2 page personal statement that addresses professional experiences, future goals, and an understanding that school administrators must possess a comprehensive conceptual, pedagogical, and reflective knowledge base
- Follow all admission guidelines established by UNC Charlotte's Graduate School

Certificate Requirements

Required Courses (21 credit hours)

ADMN 6100 - Fundamentals of Educational Leadership (3)
ADMN 6105 - Legal Aspects of Schooling (3)
ADMN 6110 - School Leadership and Management (3)
ADMN 6120 - Instructional Leadership (3)
ADMN 6161 - Principalship (3)
ADMN 6410 - Internship and Seminar Part I (1-9)
ADMN 6420 - Internship and Seminar Part II (1-9)

Optional Courses (these do not count toward certificate completion)

ADMN 6490 - Internship and Seminar: Administration (3-6)
ADMN 6491 - Internship and Seminar: Supervision (3-6)

Certificate Total = 21 Credit Hours

Post-Master's Certificate in University and College Teaching

This is a Distance Education program.

The Post-Master's Certificate in University and College Teaching prepares graduate students, postdoctoral scholars, current faculty, and others with the skills needed for the full range of faculty responsibilities at institutions of higher education.

Admission Requirements

- Master's degree from a college or university accredited by an accepted accrediting body or pursuing a doctoral degree
- GPA of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school) *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
- Online application through the Graduate School's application system
- Statement of purpose
- Unofficial transcripts of all college coursework attempted

Certificate Requirements

Required Courses (12 credit hours)

ADMN 8171 - The American College Student (3)
ADMN 8695 - Advanced Seminar in Teaching and Learning (3)
ELDT 8150 - Design, Development, and Evaluation of Online Learning Systems (3)
GRAD 8201 - Teaching at the University Level (2 to 3) or EDCI 8681 - Seminar in College Teaching (3)

Certificate Total = 12 Credit Hours

EDUCATIONAL RESEARCH, MEASUREMENT, AND EVALUATION

- Ph.D. in Educational Research, Measurement, and Evaluation
- Graduate Certificate in Quantitative Analyses

Department of Educational Leadership
edld.charlotte.edu

Ph.D. in Educational Research, Measurement, and Evaluation

The doctoral program at UNC Charlotte prepares professionals who seek advanced research, statistical, and evaluation skills for positions in a wide variety of educational institutions including higher education, K-12 school districts, for-profit companies, nonprofit agencies, community colleges, think tanks, government organizations, and other institutions concerned with solving problems in education.

The program builds on the Master of Education (M.Ed.) or comparable program. The 60-credit Ph.D. program includes 9 credit hours in foundations, 21 credit hours in research methodology and data analyses, 15 credit hours in a major area of focus, 6 credit hours in internship, and 9 credit hours in dissertation design and study. Additional coursework may be required for students who do not have a foundation in research.

Admission Requirements
Applications for admission are accepted twice a year to begin doctoral studies in the Fall or Spring semester.

The following documents/activities must be submitted in support of the application:

- Official transcript(s) of all academic work attempted since high school indicating a GPA of 3.5 (on a scale of 4.0) in a graduate degree program*
- Official report of score on the GRE or MAT that is no more than 5 years old*
- At least three references* of someone who knows the applicant's current work and/or academic achievements in previous degree work
- A two page essay describing prior educational and research experiences and objectives for pursuing doctoral studies*
- A current resume or vita
- A professional writing sample (e.g., published article, manuscript submitted for publication, term paper submitted in prior coursework, abstract of thesis, teaching manual)
- International students must submit official and acceptable English language proficiency test scores on the Test of English as a Foreign Language (TOEFL), the Michigan English Language Assessment Battery (MELAB), or the International English Language Testing System (IELTS). All tests must have been taken within the past two years**

**These items are required of applicants to any of UNC Charlotte' s doctoral programs.*

***See the Graduate School's website for minimum acceptable scores.*

Students are admitted for either full-time study or intensive part-time study and begin in the Fall or Spring semester. Students must complete their degree, including the dissertation, within nine years. The minimum time for completion for a full-time student is 3 years.

Degree Requirements
Core Courses (9 credit hours)
EDCI 8180 - Critical Issues and Perspectives in Urban Education (3)
RSCH 8196 - Program Evaluation Methods (3)
RSCH 8210 - Applied Research Methods (3)

Research Methods and Advanced Content Courses (21 credit hours)
RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8111 - Qualitative Research Methods (3)
RSCH 8120 - Advanced Statistics (3)
RSCH 8121 - Qualitative Data Collection and Analysis (3)
RSCH 8140 - Multivariate Statistics (3)
RSCH 8197 - Design and Analysis of Experimental and Quasi-Experimental Evaluations (3)
RSCH 8220 - Educational and Psychological Measurement (3)
or RSCH 8230 - Theory and Applications of Measurement (3)

Major Area of Focus Courses (15 credit hours)
Students select an area of specialization in the research degree program. This offers students the opportunity to develop advanced expertise in an area relevant to their future professional research practice. The 15-credit hour

area of focus is approved by the student's advisor and Graduate Program Director and must be aligned to the themes found in Educational Research, Measurement, and Evaluation. The most common areas of expertise include Educational Measurement, Educational Evaluation, Educational Research Methodology, and Applied Research in specific educational content areas. Commonly offered RSCH courses are listed here. Graduate level courses selected from ADMN, EDCI, RSCH, EIST, PSYC, PPOL, or SOCY may be applied.

RSCH 8112 - Survey Research Methods (3)
RSCH 8113 - Single-Case Research (3)
RSCH 8150 - Structural Equation Modeling (3)
RSCH 8160 - Hierarchical Linear Models in Education (3)
RSCH 8220 - Educational and Psychological Measurement (3)
RSCH 8230 - Theory and Applications of Measurement (3)

Internship (6 credit hours)

Three credit hours of RSCH 8410 are required. The remaining three credit hours can be met with either RSCH 8410 or RSCH 8411.

RSCH 8410 - Internship in Educational Research (3)
RSCH 8411 - Internship in Teaching Educational Research (3)

Proposal Design (3 credit hours)

RSCH 8699 - Dissertation Proposal Design (3)

Dissertation (minimum 6 credit hours)

RSCH 8999 - Doctoral Dissertation Research (1 to 9)

The purpose of the dissertation is for doctoral students to demonstrate their ability to synthesize the professional literature and generate new knowledge for the profession through using well-established research tools. For the Ph.D. in Education Research, Measurement, and Evaluation Education, the dissertation may be quantitative, qualitative, or mixed methods. Whatever type of design, it must adhere to current standards for quality as reflected in professional writing on the chosen method of research design and reflected in the current literature. Students are also permitted to select the three-article dissertation format in consultation with their advisor. Students must be continuously enrolled for dissertation research credits through and including the semester of graduation. Defense of the dissertation is conducted in a final oral examination that is open to the University community.

Portfolio Requirement

In addition to coursework and the dissertation, students must complete a portfolio that serves as a Qualifying Examination and includes demonstration of writing, collaboration, and research skills. Students receive opportunities to build this portfolio through the research and practice coursework. Products in the portfolio include: reflective statement, literature review, empirical journal article submission, empirical journal article review, conference presentation, and professional organization involvement.

Degree Total = 60 Credit Hours

Application for Degree

Students must submit an Application for Degree during the semester in which they successfully defend their dissertation proposal. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School.

Transfer Credit

The program accepts up to two courses as transfer from a doctoral-granting college or university accredited by an accepted accrediting body providing the Education Research Doctoral Committee determines that the course or courses to be transferred are equivalent to similar courses required in the UNC Charlotte Ph.D. program or fit the specialty area. The grade in these transfer courses must be an A or B. All of the dissertation work must be completed at UNC Charlotte.

Graduate Certificate in Quantitative Analyses

The Graduate Certificate in Quantitative Analyses prepares graduate students, postdoctoral scholars, current faculty, and others with the skills needed for the full range of quantitative analyses used in research.

Admission Requirements

1) Official transcript(s) of all academic work attempted since high school indicating a GPA of 3.5 (on a scale of 4.0) in a graduate degree program.
2) At least three references of someone who knows the applicant's current work and/or academic achievements in previous degree work.
3) A two page essay describing prior educational and research experiences and objectives for pursuing doctoral studies.
4) A current resume or vita.
5) A professional writing sample (e.g., published article, manuscript submitted for publication, term paper submitted in prior coursework, abstract of thesis, teaching manual).
6) A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet based) or a minimum IELTS band score of 6.5 is required for any

applicant whose native language is not English. All tests must have been taken within the past two years.

Certificate Requirements

The graduate certificate program requires 12 credit hours from the following courses:

RSCH 6110 - Descriptive and Inferential Statistics (3)
RSCH 6120 - Advanced Statistics (3)
RSCH 7140 - Multivariate Statistics (3)
RSCH 7160 - Hierarchical Linear Models in Education (3)

Students also enrolled in the Ph.D. in Educational Research, Measurement, and Evaluation should substitute the following courses:

RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8120 - Advanced Statistics (3)
RSCH 8140 - Multivariate Statistics (3)
RSCH 8150 - Structural Equation Modeling (3)
or RSCH 8160 - Hierarchical Linear Models in Education (3)

Certificate Total = 12 Credit Hours

ELEMENTARY EDUCATION

- Master of Education in Elementary Education (M.Ed.) *(for individuals with a bachelor's degree and license in Elementary Education)*
  - Academically or Intellectually Gifted
  - Anti-Racism
  - Elementary Mathematics
  - Literacy
  - Science, Technology, Engineering, and Mathematics (STEM)
- Master of Arts in Elementary Education (M.A.T.) *(for individuals with an approved bachelor's degree, not in Elementary Education, who are seeking licensure and a master's degree in Elementary Education or for individuals who have completed the Graduate Certificate)*
- Graduate Certificate in Teaching - Elementary Education
- Graduate Certificate in Elementary Mathematics Education
- Graduate Certificate in Instructional Coaching

Department of Reading and Elementary Education

reel.charlotte.edu

M.Ed. in Elementary Education

The M.Ed. in Elementary Education is designed for experienced teachers who wish to become instructional leaders, advanced practitioners, and global educators. Upon completion of the program, students will qualify for the North Carolina advanced Standard Professional II teaching license in Elementary Education.

1) Instructional Leader

This degree program enables graduates to develop leadership skills as well as specialized content knowledge to effectively impact elementary education. Graduates of this program will also be advocates for students' cultural and academic needs as well as advocates for effective and relevant educational practices and policies.

2) Advanced Practitioners

Completion of this degree program will enable graduates to acquire deep theoretical and content knowledge to become advanced practitioners in specific emphasis areas. Graduates will have the capacity to facilitate student learning through inquiry-based practices. Graduates will also possess knowledge and practice that will prepare them to enter Ph.D. programs throughout the country and world.

3) Global Educators

Graduates of this degree program will contribute to a rigorous and critical analysis of learning in their classroom, the school, and global society. The program enables graduates to promote an educational milieu that values culture, reflective practice, and multiple worldviews.

Program Goals

- Master teachers are self-directed and ethical in their personal and professional growth as educators.
- Master teachers are responsive to children's differences as influenced by development, exceptionalities, and diversity.
- Master teachers are well-grounded in the technology, content, and pedagogy of the elementary curriculum and emphasis area.
- Master teachers are effective in urban, rural, and suburban cultural contexts
- Master teachers are self-reflective, educational advocates, and educational researchers.
- Master teachers are collaborative and impactful educational leaders.
  Master teachers are globally aware of the impact of local education.

Concentrations

Concentrations available in the M.Ed. in Elementary Education program include:

- Academically or Intellectually Gifted
- Anti-Racism
- Elementary Mathematics
- Literacy
- Science, Technology, Engineering, and Mathematics (STEM)

Admission Requirements

1) Official transcripts of all previous academic work beyond high school with a minimum undergraduate GPA of 3.0
2) Completion of a Bachelors in Elementary Education from an approved program
3) Official reports of GRE or MAT examination
4) An essay describing statement of purpose for undertaking graduate study
5) Apply online: graduateschool.charlotte.edu

GRE/MAT Waiver

The GRE or MAT requirement is waived for applicants with a cumulative undergraduate GPA of 3.0 or above.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The M.Ed. in Elementary Education is a 30 credit hour online program. The program of study includes 15 credit hours of required core courses, with the remaining credit hours from a selected concentration and elective courses.

Core Courses (15 credit hours)

Phase I. Developing Perspectives (6 credit hours)

ELED 6200 - Current Issues in Global and Urban Elementary Schools (3)
ELED 6202 - Creating Equitable Elementary Classroom Environments (3)

Phase II. Collaborative Inquiry (6 credit hours)

ELED 6203 - Instructional Differentiation for 21st Century Learners (3)
RSCH 6101 - Research Methods (3)

Phase III. Investigative Leadership (3 credit hours)

ELED 6303 - Teacher Inquiry and Data Analysis in the Elementary Classroom (3)

Concentration Courses (11-15 credit hours)

Academically or Intellectually Gifted Concentration (12 credit hours)*

SPED 5211 - Nature and Needs of Gifted Students (3)
SPED 6124 - Methods of Instructing Gifted Students (3)
SPED 6161 - Social and Emotional Needs of Gifted Students (3)
SPED 6224 - Adapting Curriculum Material and Classroom Differentiation (3)

**This concentration leads to the North Carolina Licensure if the student successfully completes all of the related licensure requirements.*

Anti-Racism Concentration (12 credit hours)*

ELED 6260 - History and Psychology of Racism (3)
ELED 6261 - Racial Identity (3)
ELED 6262 - Race in Education and Schooling (3)
ELED 6263 - Anti-Racist Activism in Education (3)

**This concentration leads to the North Carolina Licensure if the student successfully completes all of the related licensure requirements.*

Elementary Mathematics Concentration* (15-18 credit hours)

ELED 6311 - Number Systems and Operations: K-5 Mathematical Tasks (3)
ELED 6312 - Geometry and Spatial Visualization: K-5 Assessment (3)
ELED 6313 - Algebraic Reasoning: K-5 Discourse and Questioning (3)
ELED 6314 - Rational Numbers and Operations: K-5 Learning Trajectories (3)
ELED 6315 - Data Analysis and Measurement: K-5 Classroom Interactions (3)
Note: - ELED 6316 (Mathematical Modeling: K-5 Leadership) must also be completed in order to earn the North Carolina Add-On License

**This concentration leads to the North Carolina Licensure if the student successfully completes all of the related licensure requirements.*

Literacy Concentration (15 credit hours)

READ 6100 - Trends and Issues in Literacy and Leadership (3)
READ 6204 - Teaching Reading to English Language Learners (3)
READ 6250 - Emergent and Elementary Literacy (3)
READ 6252 - K-12 Writing Development and Instruction (3)
READ 6265 - Multiliteracies in a Global World: Reading and Writing Texts in New Times (3)

Science, Technology, Engineering, and Mathematics (STEM) Education Concentration (15 credit hours)

ELED 6210 - Current Issues in STEM Education (3)
ELED 6211 - Integrating Engineering into the Elementary School Curriculum (3)
ELED 6212 - Integrating Digital Learning and STEM with Elementary School Learners (3)
ELED 6213 - Global Awareness in STEM Education (3)
ELED 6214 - Designing and Developing STEM Curricula (3)

Elective Course (3 credit hours)

An elective course may include any non-required course selected from a variety of graduate-level course offerings within the College of Education, designed to support concentration, additional research courses, and advanced knowledge in specific content. Advisor approval for elective courses must be granted via permit.

Capstone Requirement

The capstone experience for the M.Ed. in Elementary Education is fulfilled by successfully completing the Teacher Inquiry Project in the ELED 6303 course. Only students in their final semester of coursework are eligible to enroll in ELED 6303.

Degree Total = 30 Credit Hours

Clinical Field Experiences

Students in the M.Ed. program participate in structured field experiences that require them to apply coursework in their classroom settings, analyze K-5 student learning, and reflect on their practice in the context of theories on teaching and learning. Students deepen their understanding of the knowledge, skills, and professional dispositions that foster student learning. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. These structured field experiences are designed to take place in multiple settings within the candidate's school community or districts, after-school programs, alternate youth centers, or in the schools and classrooms in which the candidates work.

Advising

All students are assigned an advisor upon formal admission to the program. Students are required to attend the advising seminar at the start of each semester.

Licensure

The master's (M.Ed.) program in Elementary Education is a K-6 instructional degree that leads to the "M" level teaching license.

Research Opportunities/Experiences

Faculty members in the Department of Elementary Education faculty are deeply committed to research in urban schools. As a result, candidates will have opportunities to become involved in classroom-based research.

M.A.T. in Elementary Education

The Master of Arts in Teaching (M.A.T.) program is designed for individuals who hold a bachelor's degree. The M.A.T. program is a 30 credit hour program composed of two phases: the Graduate Certificate phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I leads to the initial Standard Professional I teaching license in Elementary Education. Phase I requires 21 credit hours of coursework, including the graduate student teaching/internship experience. Upon completion of Phase I, qualified candidates may apply for the M.A.T. in Elementary Education (Phase II). The M.A.T. in Elementary Education is a part of the University of North Carolina Distance Education Consortium (online.northcarolina.edu). Completion of the remaining requirements for the Master's degree (Phase II)

qualifies candidates for the advanced Standard Professional II teaching license.

All courses for both phases of the Graduate Certificate/M.A.T. must be completed within seven years. Coursework within Phase I/Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to the information found in The Graduate School section of this *Catalog*.

Admission Requirements for all M.A.T. programs

1) Completion of the Graduate Certificate in Teaching
2) Minimum graduate GPA of 3.5 in the Graduate Certificate in Teaching in Elementary Education
3) Statement of purpose
4) Apply online at graduateschool.charlotte.edu

Degree Requirements

Phase I: Graduate Certificate Courses

Required Courses (15 credit hours)

ELED 5110 - Developing a Productive and Equitable Learning Environment (2)
ELED 5112L - Practice-Based Teaching I Lab (1)
ELED 5210 - Essentials of Teaching Mathematics to Elementary School Learners (2)
ELED 5212L - Practice-Based Teaching II Lab (1)
ELED 5310 - Teaching and Assessment of Mathematics for Elementary School Learners (2)
ELED 5312L - Practice-Based Teaching III Lab (1)
READ 5111 - Essentials of Literacy Instruction (2)
READ 5211 - Methods of Literacy (2)
READ 5311 - Literacy Assessment and Tiered Interventions (2)

Internship/Student Teaching (6 credit hours)

The graduate-level student teaching/internship is the culminating experience in Phase I of the M.A.T, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. It must be taken in the final semester for the initial licensure program. Students are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and University faculty. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place at least one semester before student teaching.

ELED 6470 - Graduate Student Teaching/Internship in Elementary Education (6)

Phase II: Completion of the M.A.T.

Required Courses (9 credit hours)

Elementary education courses taken in Phase II of the M.A.T. require employment as an elementary teacher.

ELED 6202 - Creating Equitable Elementary Classroom Environments (3)
ELED 6203 - Instructional Differentiation for 21st Century Learners (3)
ELED 6303 - Teacher Inquiry and Data Analysis in the Elementary Classroom (3) *

** ELED 6303 is the Capstone Course and must be taken in the final semester of the program.*

Degree Total = 30 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences

All courses require students to develop their knowledge, skills, and dispositions in public school/agency settings. *During Phase I of the program, all students are expected to complete clinical experiences in at least three significantly different settings.*

Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze K-6 student learning, and develop the ability to positively impact all learners. Each course in Phase I of the program requires 20 clinical hours. These structured experiences can take place in multiple settings such as neighboring schools or districts, after-school programs, or in the schools and classrooms in which the candidates work. All elementary education courses in Phase II of the program require employment as an elementary teacher as extensive action research is done in the classroom setting.

Candidates who are residency teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor. A limited number of clinical experiences may be approved in *significantly different* classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Licensure

Upon successful completion of the Phase I/Graduate

Certificate, teacher candidates will be recommended for the North Carolina Standard Professional I teaching license. For this license, students are required to complete all NC State mandated testing/performance assessment requirements for licensure.

Upon successful completion of Phase II, students will be recommended for the North Carolina advanced Standard Professional II teaching license. For the advanced license, students are required to complete an advanced electronic licensure portfolio during coursework.

Research Opportunities/Experiences

Faculty members in the Department of Reading and Elementary Education are deeply committed to research in urban schools. As a result, candidates will have opportunities to become involved in practical and meaningful classroom-based research.

Graduate Certificate in Teaching: Elementary Education

The Graduate Certificate in Teaching: Elementary Education is a 21 credit hour program designed for students who hold a bachelor's degree. Upon successful completion of the Graduate Certificate, students are eligible for the North Carolina Standard Professional I teaching license.

The required courses for the Graduate Certificate are identical to Phase I of the M.A.T. Upon completion of the Graduate Certificate, qualified students have the option of continuing into Phase II to complete the M.A.T. Admission to the Graduate Certificate is separate and distinct from admission to a graduate degree program and not an indication of automatic admission to the M.A.T. degree program. For more information on this option, refer to the M.A.T. section above.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to the information found in The Graduate School section of this *Catalog*.

Admission Requirements for all Graduate Certificates in Teaching Programs

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75. *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of your interaction with children or youth
4) Statement of purpose
5) Clear criminal background check
6) Apply online at graduateschool.charlotte.edu

Certificate Requirements

Required Courses (15 credit hours)

ELED 5110 - Developing a Productive and Equitable Learning Environment (2)
ELED 5112L - Practice-Based Teaching I Lab (1) *
ELED 5210 - Essentials of Teaching Mathematics to Elementary School Learners (2)
ELED 5212L - Practice-Based Teaching II Lab (1) *
ELED 5310 - Teaching and Assessment of Mathematics for Elementary School Learners (2)
ELED 5312L - Practice-Based Teaching III Lab (1) *
READ 5111 - Essentials of Literacy Instruction (2)
READ 5211 - Methods of Literacy (2)
READ 5311 - Literacy Assessment and Tiered Interventions (2)

** Lab courses are offered in a hybrid format and require some in-class meetings.*

Internship/Student Teaching (6 credit hours)

The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. A GPA of 3.0 or above in the graduate certificate coursework is required to be eligible for the student teaching/internship. Students are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and University faculty. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place at least one semester before student teaching. The prerequisite for the student teaching/internship is completion of all program coursework, a GPA of 3.0 or above, an application for the course by the established deadline, and approval of the department.

ELED 6470 - Graduate Student Teaching/Internship in Elementary Education (6) **

*** Must be taken in the final semester for the initial licensure program.*

Certificate Total = 21 Credit Hours

Advising
All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences
All courses require students to develop their knowledge, skills, and dispositions in public school/agency settings. During the Graduate Certificate in Elementary Education program, all students are expected to complete clinical experiences in at least three significantly different settings.

Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze K-6 student learning, and develop the ability to positively impact all learners. The first semester requires a minimum of 30 hours of clinical experiences. The second semester requires a minimum of 36 hours of clinical experiences. The third semester requires a minimum of 40 hours of clinical experiences. These structured experiences can take place in multiple settings such as neighboring schools or districts, after-school programs, or in the schools and classrooms in which the candidates work or are placed by the Office of School and Community Partnerships.

Candidates who are lateral entry teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Licensure
Upon successful completion of the Phase I/Graduate Certificate, teacher candidates will be recommended for the North Carolina Standard Professional I teaching license. For this license, students are required to complete all NC State mandated testing/performance assessment requirements for licensure.

Graduate Certificate in Elementary Mathematics Education

The Graduate Certificate in Elementary Mathematics Education is an 18 credit hour program designed for students who hold a North Carolina Teaching License with either certification in Elementary Education (Grades K-6) OR Middle Grades Education (Grades 6-8) and certified in Middle Grades Mathematics.

Upon successful completion of the Graduate Certificate, students are eligible for the North Carolina Add-on License in Elementary School Mathematics.

Upon completion of the Graduate Certificate, qualified students have the option of applying to the M.Ed. in Elementary Education program. Admission to the Graduate Certificate program is separate and distinct from admission to a graduate degree program and not an indication of automatic admission to the M.Ed. degree program. For more information on this option, refer to the M.Ed. section above.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School
Please refer to the information found in The Graduate School section of this *Catalog*.

Graduate Certificate Program Admission Requirements
1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) A North Carolina teaching license in Elementary Education (Grades K-6) OR Middle Grades Education (Grades 6-8) and certified in Middle Grades Mathematics
4) Three recommendations from persons knowledgeable of the candidate's interaction with children or youth, including a current administrator at the school in which the candidate works
5) Clear criminal background check
6) Apply online at http://graduateschool.charlotte.edu

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements
ELED 6311 - Number Systems and Operations: K-5 Mathematical Tasks

ELED 6312 - Geometry and Spatial Visualization: K-5 Assessment
ELED 6313 - Algebraic Reasoning: K-5 Discourse and Questioning
ELED 6314 - Rational Numbers and Operations: K-5 Learning Trajectories
ELED 6315 - Data Analysis and Measurement: K-5 Classroom Interactions
ELED 6316 - Mathematical Modeling: K-5 Leadership

Certificate Total = 18 Credit Hours

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in public school/agency settings. *During the Graduate Certificate in Elementary Mathematics Education program, all students are expected to complete clinical experiences in elementary school settings.*

Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. Each course in the program requires 20 clinical hours. These structured experiences can take place in multiple settings such as neighboring schools or districts, after-school programs, or in the schools and classrooms in which the candidates work.

Candidates who are residency teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor. A limited number of clinical experiences may be approved in *significantly different* classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Licensure

Upon successful completion of the Graduate Certificate, students will be recommended for the North Carolina Standard Professional I teaching license. For this license, students are required to complete an electronic licensure portfolio that is created during coursework and student teaching.

Graduate Certificate in Instructional Coaching

The Graduate Certificate in Instructional Coaching is a 12 credit hour program designed for those interested in becoming instructional leaders who facilitate job-embedded professional development in P-12 schools. The required courses develop candidates' knowledge and skills in coaching novice and veteran teachers to improve instruction, design quality curriculum, and effectively use data to guide instruction, as well as determine areas for development.

Admission Requirements

- Undergraduate degree in education or closely related field from a college or university accredited by an accepted accrediting body
- Minimum undergraduate GPA of 2.75
- Three years of successful teaching experience or other professional education experience
- Two letters of reference from current or past supervisors (must include principal) that document leadership and/or administrative experiences and potential for success as an instructional coach
- Personal statement of purpose
- Clear criminal background check

Certificate Requirements

EDUC 6150 - Principles of Coaching I (3)
EDUC 6151 - Coaching for an Equitable Learning Environment (3)
EDUC 6152 - Principles of Coaching II (3)
EDUC 6153 - Application of Coaching Principles (3)

Certificate Total = 12 Credit Hours

Grade Requirements

Students must achieve a minimum 3.0 GPA to complete the certificate. No more than one grade of C may count towards the certificate.

FOREIGN LANGUAGE EDUCATION

- Master of Arts in Teaching (M.A.T.) in Foreign Language Education
  - American Sign Language
  - Arabic
  - Cherokee
  - Chinese
  - French
  - German
  - Japanese
  - Greek (Ancient)
  - Greek (Modern)
  - Hebrew
  - Hindi
  - Italian
  - Korean
  - Latin
  - Portuguese
  - Russian
  - Spanish
  - Swahili
  - Turkish
- Graduate Certificate in Teaching in Foreign Language Education
  - American Sign Language
  - Arabic
  - Cherokee
  - Chinese
  - French
  - German
  - Japanese
  - Greek (Ancient)
  - Greek (Modern)
  - Hebrew
  - Hindi
  - Italian
  - Korean
  - Latin
  - Portuguese
  - Russian
  - Spanish
  - Swahili
  - Turkish

Department of Middle, Secondary, and K-12 Education

mdsk.charlotte.edu

M.A.T. in Foreign Language Education

The Master of Arts in Teaching (M.A.T.) in Foreign Language Education program is a 31-32 credit hour program composed of two phases: the Graduate Certificate in Teaching phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I of the M.A.T. leads to the initial Standard Professional I teaching license. Phase I requires 16-17 credit hours of coursework, including the graduate student teaching/internship experience. Upon completion of Phase I, qualified candidates may apply to continue into Phase II to complete the remaining requirements for the Master's degree and qualify for the advanced Standard Professional II teaching license.

All courses for both phases of the M.A.T. must be completed within seven years. Coursework within Phase I/Graduate Certificate must be completed within five years.

This Graduate Certificate program is offered 100% online through the Office of Distance Education. For more information, visit distanceed.charlotte.edu.

Admission Requirements

Admission Requirements for the Graduate School

Please refer to admission information in the Admission to the Graduate School section of this Catalog.

Admission Requirements for all M.A.T. Programs

- Completion of the Graduate Certificate in Teaching
- A minimum graduate GPA of 3.5 in the Graduate Certificate in Teaching*
- One recommendation from a full-time faculty member who has taught you in the Graduate Certificate in Teaching program
- A statement of purpose

The admission process includes the Application for Graduation from the Graduate Certificate program. Interested applicants may apply online at the Graduate Admissions website.

**Students with a GPA below 3.5 in the Graduate Certificate phase may be considered for admission to the M.A.T. program with scores above the 30th percentile on either the GRE or Miller Analogies Test.*

Admission Requirements for Foreign Language Education

Candidates with an undergraduate degree a college or university accredited by an accepted accrediting body and a cumulative undergraduate GPA of 2.7 have 3 options to gain admission to the Graduate Certificate in Foreign Language Education program:

- **Option 1:** Candidates who have a bachelor's degree with a major in the intended language of instruction
- **Option 2:** Demonstrate native or near-native speaker proficiency in the intended language of instruction via a passing score on the Praxis Subject Assessment or a minimum score of Advanced Low on the ACTFL Oral Proficiency Interview (OPI) AND Writing Proficiency test (WPT) in the intended language of instruction
- **Option 3:** Candidates who have the equivalent of a major in the intended language of instruction via completion of a minimum of 24 credit hours of post-secondary coursework in the intended language of instruction. At least two of these courses must be at the 4000 (advanced) level and all must be conducted in the foreign language in which they are seeking licensure. Candidates choosing to pursue this admission route must contact the Office of Teacher Education Advising and Licensure (TEAL) for advising.

Candidates pursuing a license in one of the following languages are eligible for admission to the Graduate Certificate in Foreign Language Education. Due to limited availability of internship sites, candidates seeking licensure in the less commonly taught languages (indicated with an asterisk below) must be residency teachers and complete the internship in their own classroom.

- American Sign Language (K-12)*
- Arabic (K-12)
- Cherokee (K-12)*
- Chinese (K-12)
- French (K-12)
- German (K-12)
- Japanese (K-12)
- Greek (Ancient) (K-12)*
- Greek (Modern) (K-12)*
- Hebrew (K-12)*
- Hindi (K-12)*
- Italian (K-12)*
- Korean (K-12)*
- Latin (K-12)*
- Portuguese (K-12)*
- Russian (K-12)*
- Spanish (K-12)
- Swahili (K-12)*
- Turkish (K-12)*

Prior to admission into the final semester of student teaching, candidates must demonstrate proficiency in the foreign language via reaching a benchmark score on the Oral Proficiency Interview.

Degree Requirements

Phase I: Graduate Certificate in Teaching (16-17 credit hours)

Methods I Block Courses (3 credit hours)
MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Equity and Education Course (2 credit hours)
MDSK 5204 - Equity and Education (2)

Methods II Block Courses (4 credit hours)
FLED 5200 - Methods in Teaching Foreign Languages (3)
MDSK 5100L - Content Pedagogy Lab (1)

Assessment Course (2 credit hours)
FLED 5104 - Assessment in the Teaching of K-12 Foreign Languages (2)

Customized Course (2-3 credit hours)
In consult with advisor, select one of the following:

MDLG 5130 - The Middle Grades Experience (2)
SECD 5140 - The Secondary School Experience (2)
Advanced Content Course (5000-6999) in the intended licensure area (3) *(French, German, or Spanish only)*

Internship/Student Teaching (3 credit hours)
The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Students are assigned to an appropriate classroom with a licensed K-12 teacher (in the intended licensure area) for a full-time, semester-long experience under the supervision of the classroom teacher and University faculty. Residency teachers must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. Prior to student teaching, foreign language education teacher candidates must demonstrate advanced language skills by obtaining a minimum score of Advanced Low on the related Oral Proficiency Interview (OPI) in the language of intended licensure. There is no required internship for Phase II of the M.A.T. program.

FLED 6470 - Graduate Student Teaching and Internship - Foreign Language Education (3 to 6)

Phase II: Completion of the M.A.T. (15 credit hours)

Specialized Pedagogy Course (3 credit hours)
Select one of the following:
MDSK 6220 - Adolescence and Learning (2 or 3)
TESL 6206 - Globalization, Communities, and Schools (3)

Methods Courses (6 credit hours)
RSCH 6101 - Research Methods (3)
FLED 6200 - Advanced Methods of Teaching Foreign Languages (3)

Leadership Course (3 credit hours)
MDSK 6260 - Teacher Leadership (3)

Capstone Course (3 credit hours)
Candidates complete the Comprehensive Electronic Portfolio project within the Capstone Course. In addition, candidates for the M.A.T. complete an electronic licensure portfolio during coursework that demonstrates their readiness for the advanced Standard Professional II teaching license.

MDSK 6691 - Seminar in Professional Development (3)

Degree Total = 31-32 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and

socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. *All students are expected to complete clinical experiences in at least two significantly different settings.* Residency teacher candidates are permitted to complete clinical hours in their own school sites.

Alternative settings must be approved by the instructor and may include schools on different schedules, after-school and summer programs, Saturday programs, private, and charter schools.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, students will be recommended for the North Carolina initial Standard Professional I teaching license. For this initial license, students are required to complete an electronic licensure portfolio that is created during coursework and student teaching. Upon successful completion of Phase II, students will be recommended for the North Carolina advanced Standard Professional II teaching license. For the advanced license, students are required to complete an advanced electronic licensure portfolio during coursework.

Graduate Certificate in Teaching: Foreign Language Education

The Graduate Certificate in Foreign Language Education consists of 16-17 credit hours and is a distance education program which combines web-based and off-campus courses; students must be geographically located in the State of North Carolina. The certificate is designed for individuals with a bachelor's degree. Upon completion of the graduate certificate, students are eligible for the North Carolina Initial Standard Professional I (SP1) teaching license.

The 16-17 credit-hours earned from the Graduate Certificate may also be applied toward the Master of Arts in Teaching Foreign Language Education upon acceptance to the Master's program. Completion of the Master's degree leads to the advanced "M" teaching license.

All courses for the Graduate Certificate must be completed within five years.

Admission Requirements

Admission Requirements for the Graduate School

Please refer to admission information in the Graduate School section of this Catalog.

Admission Requirements for all Graduate Certificates in Teaching Programs

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.7 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of the candidate's interaction with children or youth
4) Statement of purpose
5) Clear criminal background check
6) Apply online at gradadmissions.charlotte.edu

Admission Requirements for Foreign Language Education

Candidates with an undergraduate degree from a college or university accredited by an accepted accrediting body and a cumulative undergraduate GPA of 2.7 have 3 options to gain admission to the Graduate Certificate in Foreign Language Education program:

- **Option 1:** Candidates who have a bachelor's degree with a major in the intended language of instruction
- **Option 2:** Demonstrate native or near-native speaker proficiency in the intended language of instruction via a passing score on the Praxis Subject Assessment or a minimum score of Advanced Low on the ACTFL Oral Proficiency Inteview (OPI) AND Writing Proficiency test (WPT) in the intended language of instruction
- **Option 3:** Candidates who have the equivalent of a major in the intended language of instruction via completion of a minimum of 24 credit hours of post-secondary coursework in the intended language of instruction. At least two of these courses must be at the 4000 (advanced) level and all must be conducted in the foreign language in which they are seeking licensure. Candidates choosing to pursue this admission route must contact the Office of Teacher Education Advising and Licensure (TEAL) for advising.

Candidates pursuing a license in one of the following languages are eligible for admission to the Graduate Certificate in Foreign Language Education. *Due to limited availability of internship sites, candidates seeking licensure in the less commonly taught languages (indicated with an asterisk * below) must be residency teachers and complete the internship in their own classroom.*

- American Sign Language (K-12)*
- Arabic (K-12)
- Cherokee (K-12)*
- Chinese (K-12)
- French (K-12)
- German (K-12)
- Japanese (K-12)

- Greek (Ancient) (K-12)*
- Greek (Modern) (K-12)*
- Hebrew (K-12)*
- Hindi (K-12)*
- Italian (K-12)*
- Korean (K-12)*
- Latin (K-12)*
- Portuguese (K-12)*
- Russian (K-12)*
- Spanish (K-12)
- Swahili (K-12)*
- Turkish (K-12)*

Prior to admission into the final semester of student teaching, candidates must demonstrate proficiency in the foreign language via reaching a benchmark score on the Oral Proficiency Interview.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Methods I Block Courses (3 credit hours)

MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)

Equity and Education Course (2 credit hours)

MDSK 5204 - Equity and Education (2)

Methods II Block Courses (4 credit hours)

FLED 5200 - Methods in Teaching Foreign Languages (3)
MDSK 5100L - Content Pedagogy Lab (1)

Assessment Course (2 credit hours)

FLED 5104 - Assessment in the Teaching of K-12 Foreign Languages (2)

Customized Course (2-3 credit hours)

In consult with advisor, select one of the following:

MDLG 5130 - The Middle Grades Experience (2)
SECD 5140 - The Secondary School Experience (2)
Advanced Content Course (5000-6999) in the intended licensure area (3)

Internship/Student Teaching (3 credit hours)

The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Students are assigned to an appropriate classroom with a licensed K-12 teacher (in the intended licensure area) for a full-time, semester-long experience under the supervision of the classroom teacher and University faculty. Residency teachers must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. Prior to student teaching, foreign language education teacher candidates must demonstrate advanced language skills by obtaining a minimum score of Advanced Low on the related Oral Proficiency Interview (OPI) in the language of intended licensure.

FLED 6470 - Graduate Student Teaching and Internship - Foreign Language Education (3 to 6)

Certificate Total = 16-17 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. *All students are expected to complete clinical experiences in at least two significantly different settings.* Residency teacher candidates are permitted to complete clinical hours in their own school sites.

Alternative settings must be approved by the instructor and may include schools on different schedules, after-school and summer programs, Saturday programs, private, and charter schools.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, students will be recommended for the North Carolina initial Standard Professional I teaching license. For this license, students are required to complete an electronic licensure portfolio that is created during coursework and student teaching.

LEARNING, DESIGN, AND TECHNOLOGY

- M.Ed. in Learning, Design, and Technology
  - School Specialist
  - Training and Development
  - Online Learning and Teaching
- Graduate Certificate in Learning, Design, and Technology
  - School Specialist
  - Training and Development
  - Online Learning and Teaching

Department of Educational Leadership
edld.charlotte.edu

M.Ed. in Learning, Design, and Technology

The M.Ed. in Learning, Design, and Technology is a 33 credit hour degree program for those pursuing learning, design and technology credentials as preparation for leadership and curriculum design in the Training and Development field; and, for those pursuing these credentials to satisfy requirements for the North Carolina Department of Public Instruction Instructional Technology Specialists: Computers. The M.Ed. in Learning, Design, and Technology program is currently the only graduate LDT programs in North Carolina holding National Recognition status from the Association for Educational Communications and Technology (AECT).

Admission Requirements
Interested applicants may apply online at gradadmissions.charlotte.edu. Applications are accepted for Fall, Spring, and Summer admissions. Check the program website for application deadlines.

The admission process is competitive and determined by the following application components:

1) Applicants are required to have a minimum of a B.A. or B.S. degree from a college or university accredited by an accepted accrediting body and a minimum undergraduate GPA of 3.0
2) Official transcripts
3) Three letters of recommendation from professionals who are able to judge the quality of the applicant as a future student in this program
4) Statement of Purpose of no more than 750 words in 12-point font and double-spaced, written definitively, coherently, and incorporating thoughtful expression in response to:
   a. What skills and knowledge do you hope to acquire and develop as a result of this program?
   b. Characterize what you would contribute to the collective learning experiences of your fellow students.
5) GRE or GMAT scores *(optional)*
6) A work sample that is appropriate for the degree such as an instructional video, portfolio, tutorial, research paper, or technology-enhanced lesson plan *(optional)*
7) Additional items required for those interested in the School Specialist concentration to satisfy the North Carolina Department of Public Instruction (NCDPI) Instructional Technology Specialists: Computers (10877). This requirement is only for those who wish to earn the 077 license. Those who wish to work in other instructional technology settings (higher education, corporate, military, government) do not have to fulfill this requirement.
   a. A valid appropriate North Carolina teaching license A or G level (or equivalent from another state). In the online admission application, there is a field in which to specify the type of teaching license. Rather than uploading a copy of the teaching license into the application system, scan the license and email a copy to the Program Director
   b. A minimum of 2 to 3 years teaching experience

Degree Requirements
The M.Ed. in Learning, Design, and Technology program requires a total of 33 credit hours comprising courses in a selected concentration, an internship, and capstone project.

Concentration Requirements
Below are the suggested courses for each concentration. Students should work with an advisor to determine the related coursework that works best in their program of study. For the most current approved courses, visit the Learning, Design, and Technology website at edld.charlotte.edu/programs/instructional-systems-technology-program.

School Specialist Concentration
This concentration is for those who work in the P-12 system and who already hold either an "A" or "G" level teaching license from the North Carolina Department of Public Instruction (or from another state) for the new Masters/Advanced "M" license in Instructional Technology Specialists.

Required Courses (18 credit hours)
ELDT 5100 - Technology Integration in Education (3)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
ELDT 6130 - Instructional Multimedia Development (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
RSCH 6101 - Research Methods (3)

Elective Courses (9 credit hours)
Select three of the following:
ELDT 6000 - Topics in Learning, Design, and Technology (1 to 6)
ELDT 6101 - Learning Principles in Learning, Design, and Technology (3)
ELDT 6120 - Current Trends in in Learning, Design, and Technology (3)
ELDT 6121 - Advanced Instructional Design (3)
ELDT 6140 - Instructional Video Development (3)
ELDT 6150 - Design, Development, and Evaluation of Online Learning Systems (3)
ELDT 6160 - Designing Learning Systems with Simulation and Game Technology (3)
ELDT 6170 - Human Performance Technology (3)
RSCH 7196 - Program Evaluation Methods (3)

Training and Development Concentration

This concentration is for instructional technology personnel who wish to do training and development in corporate, higher education, government, and military.

Required Courses (18 credit hours)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
ELDT 6121 - Advanced Instructional Design (3)
ELDT 6130 - Instructional Multimedia Development (3)
ELDT 6170 - Human Performance Technology (3)
RSCH 6101 - Research Methods (3)

Elective Courses (9 credit hours)
Select three of the following:
ELDT 6000 - Topics in Learning, Design, and Technology (1 to 6)
ELDT 6101 - Learning Principles in Learning, Design, and Technology (3)
ELDT 6120 - Current Trends in in Learning, Design, and Technology (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
ELDT 6140 - Instructional Video Development (3)
ELDT 6150 - Design, Development, and Evaluation of Online Learning Systems (3)
ELDT 6160 - Designing Learning Systems with Simulation and Game Technology (3)
RSCH 7196 - Program Evaluation Methods (3)

Online Learning and Teaching Concentration

This concentration is for those interested in designing, developing, or managing online learning and teaching.

Required Courses (18 credit hours)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
ELDT 6101 - Learning Principles in Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
ELDT 6130 - Instructional Multimedia Development (3)
ELDT 6150 - Design, Development, and Evaluation of Online Learning Systems (3)
RSCH 6101 - Research Methods (3)

Elective Courses (9 credit hours)
Select three of the following:
ELDT 6000 - Topics in Learning, Design, and Technology (1 to 6)
ELDT 6120 - Current Trends in in Learning, Design, and Technology (3)
ELDT 6121 - Advanced Instructional Design (3)
ELDT 6135 - Learning Media, Resources, and Technology (3)
ELDT 6140 - Instructional Video Development (3)
ELDT 6160 - Designing Learning Systems with Simulation and Game Technology (3)
ELDT 6170 - Human Performance Technology (3)
RSCH 7196 - Program Evaluation Methods (3)

Internship and IST Capstone Project (6 credit hours)

Students in each concentration must complete an internship and a Capstone Project as part of the Capstone experience. For more specific information regarding the Master's Capstone Project, students should contact their advisor.

ELDT 6491 - Internship in Learning, Design, and Technology (3)
ELDT 6492 - Capstone Project in Learning, Design, and Technology (3)

Degree Total = 33 Credit Hours

Licensure – Instructional Technology Specialist (North Carolina 077)

The M.Ed. Program in Learning, Design, and Technology with a School Specialist concentration also qualifies graduates who already hold either an "A" or "G" level teaching license from the North Carolina Department of Public Instruction (or from another state) for the new Masters/Advanced "M" license in Instructional Technology Specialists: Computers (NC 077) license. Students should work with an advisor to complete these requirements. Students in the other concentrations earn the M.Ed. degree, but not the 077 license.

Graduate Certificate in Learning, Design, and Technology

This graduate certificate program prepares instructional design professionals to create, analyze, use, integrate, implement, assess, evaluate and manage instructional and performance solutions. When students graduate, they hold instructional design and technology positions in education (P-12 and higher education), corporate, government, or military organizations. The program develops professionals who are solidly grounded in instructional technology foundations, principles, theories, applications, and current trends, and provides opportunities for them to integrate different forms of technology to enhance teaching and learning. Students select from one of three concentrations:

1) School Specialist (18 credit hours)
2) Training and Development (15 credit hours)
3) Online Learning and Teaching (15 credit hours)

This graduate certificate program is offered 100% online through the Office of Distance Education. For more information, visit distanceed.charlotte.edu.

Program Objectives

Aligned with the Association for Educational Communications and Technology (AECT), International Society for Technology in Education (ISTE), and North Carolina Department of Public Instruction (NCDPI) standards, this program prepares graduates to:

- Create, use, assess, and manage theoretical and practical applications of educational technologies and processes.
- Demonstrate effective analysis, integration, and implementation of educational technologies and processes based on contemporary content and pedagogy.
- Facilitate learning by creating, using, evaluating, and managing effective learning environments.
- Design, develop, implement, and evaluate technology-rich learning environments within a supportive community of practice.
- Explore, evaluate, synthesize, and apply methods of inquiry to enhance learning and improve performance.

Admission Requirements

Interested applicants may Apply online at gradadmissions.charlotte.edu. Applications are accepted for Fall, Spring, and Summer admissions. Check the program website for application deadlines.

- B.A. or B.S. degree in an appropriate field of study from a college or university accredited by an accepted accrediting body
- Official transcripts
- An undergraduate GPA of 2.75 or higher for the last two years of coursework
- Evidence of strong written and oral communication skills
- For those seeking the 079 endorsement, the following additional documents are required:
  - A valid North Carolina teacher's license
  - A minimum of 2 to 3 years teaching or other professional experience
- Statement of Purpose of no more than 750 words in 12-point font and double-spaced, written definitively, coherently, and incorporating thoughtful expression in response to:
  - How will this program help you to achieve your professional goals?
  - What skills and knowledge do you hope to acquire and develop as a result of this program?
  - Characterize what you would contribute to the collective learning experiences of your fellow students.
  - Develop your narrative so that it clearly responds to the prompts and provides the reader with definitive, coherent, and thoughtful expression.

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate certificate (Online Learning and Teaching concentration only) degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Select one of the following concentrations:

School Specialist Concentration

This concentration is for those who work in the P-12 system and who already hold either an "A" or "G" level teaching license from the North Carolina Department of Public Instruction (or from another state). School system personnel who currently hold a valid "A" or "M" level teaching license and are eligible for the Special Endorsement in Computer Education (079 License) by the North Carolina Department of Public Instruction at the end of this graduate certificate.

Required Courses (18 credit hours)
ELDT 5100 - Technology Integration in Education (3)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
ELDT 6120 - Current Trends in in Learning, Design, and Technology (3)
ELDT 6130 - Instructional Multimedia Development (3)
ELDT 6135 - Learning, Media, Resources, and Technology (3)

Training and Development Concentration
This concentration is for those who wish to do training and development in corporate, higher education, government, and military.

Required Courses (15 credit hours)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
ELDT 6130 - Instructional Multimedia Development (3)
ELDT 6160 - Designing Learning Systems with Simulation and Game Technology (3)
ELDT 6170 - Human Performance Technology (3)

Online Learning and Teaching Concentration
This concentration is for those interested in designing, developing, or managing online learning and teaching. -

Required Courses (15 credit hours)
ELDT 6100 - Foundations of Learning, Design, and Technology (3)
or ELDT 8100 - Foundations of Learning, Design, and Technology (3)
ELDT 6110 - Instructional Design (3)
or ELDT 8110 - Instructional Design (3)
ELDT 6120 - Current Trends in Learning, Design, and Technology (3)
or ELDT 8120 - Current Trends in Learning, Design, and Technology (3)
ELDT 6130 - Instructional Multimedia Development (3)
or ELDT 8130 - Instructional Multimedia Development (3)
ELDT 6150 - Design, Development, and Evaluation of Online Learning Systems (3)
or ELDT 8150 - Design, Development, and Evaluation of Online Learning Systems (3)

Certificate Total = 15-18 Credit Hours

Licensure (079 Endorsement)

School system personnel who currently hold a valid "A" or "M" level teaching license and who complete the School Specialist concentration of the Graduate Certificate in Learning, Design, and Technology are eligible to earn the Special Endorsement in Computer Education (079) by the North Carolina Department of Public Instruction.

Professionals in the other concentrations will receive the Graduate Certificate only and not the 079 endorsement.

READING EDUCATION

- M.Ed. in Reading Education
- Graduate Certificate in Advanced Literacy Instruction and Intervention

Department of Reading and Elementary Education

reel.charlotte.edu

M.Ed. in Reading Education

Designed for experienced teachers, the M.Ed. in Reading Education program qualifies graduates for the North Carolina Advanced Standard Professional II teaching license in K-12 reading education. Relevant to all areas of the K-12 curriculum, this program is designed for classroom teachers and aspiring literacy specialists who are interested in improving instructional programs and practices that promote literacy among all learners.

Based on professional standards published by the International Reading Association and the N.C. State Department of Education, the program prepares graduates who: 1) understand the theoretical and evidence-based foundations of literacy, including reading and writing processes and instruction; 2) use instructional approaches, materials and an integrated, comprehensive, balanced curriculum to support student learning in reading and writing; 3) use a variety of assessment tools and practices to plan and evaluate effective reading and literacy instruction; 4) create and engage their students in literacy practices that develop awareness, understanding, respect, and a valuing of differences and diversity in our society; and 5) demonstrate, and facilitate professional learning and leadership as a career-long effort and responsibility by serving as a resource to educate teachers, administrators, and the community.

The M.Ed. in Reading Education program is offered fully online. The program is designed as a cohort model. Students can complete the degree within two years/five semesters (Fall, Spring, Summer, Fall, Spring).

Admission Requirements

The M.Ed. in Reading Education does not have admissions testing requirements (e.g., the MAT or GRE). Applicants may elect to submit a GRE or MAT test score as part of their application but are not required for consideration for admission to the program.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The M.Ed. in Reading Education program requires a total of 33 credit hours of courses in three phases:

Phase I: Foundations of Literacy and Leadership (6 credit hours)

READ 6100 - Trends and Issues in Literacy and Leadership (3)
READ 6300 - Global Literacy in a Multicultural World: Genre Study (3)

Phase II: Developmentally Appropriate Assessment and Instruction (21 credit hours)

EDUC 6254 - Individualizing Instruction for Diverse Learners (3)
ELED 6303 - Teacher Inquiry and Data Analysis in the Elementary Classroom (3)
READ 6204 - Teaching Reading to English Language Learners (3)
READ 6252 - K-12 Writing Development and Instruction (3)
READ 6255 - Middle/Secondary Reading and Writing (3)
READ 6300 - Global Literacy in a Multicultural World: Genre Study (3)
RSCH 6101 - Research Methods (3)

Phase III: Advanced Literacy Intervention and Leadership (6 credit hours)

READ 6260 - Diagnostic Assessment and Instruction in Reading (3)
READ 6474 - Collaborative Leadership in Literacy Education (3)

Degree Total = 33 Credit Hours

Clinical Field Experiences

Students in the M.Ed. in Reading Education program participate in field experiences that require them to apply coursework in classroom settings, analyze K-12 student learning, and reflect on their practice in the context of theories on teaching and learning. Students deepen their understanding of the knowledge, skills, and professional dispositions that foster student learning. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. These field experiences are embedded in course assignments and are often conducted in a student's

classroom if they are currently teaching. These field experiences also can take place in multiple settings such as neighboring schools or districts, day care centers and afterschool programs, or youth centers.

Assistantships

The Department typically has a limited number of Graduate Assistantships, pending resources. Applications are available from the Department of Reading and Elementary Education.

Graduate Certificate in Advanced Literacy Instruction and Intervention

The Graduate Certificate in Advanced Literacy Instruction and Intervention provides K-12 teachers with skills in using data and current research on literacy to design and implement classroom literacy instruction and interventions. This is a 12 credit hour certificate program that focuses on helping teachers enhance literacy outcomes for diverse learners.

Admission Requirements

- Bachelor's degree, or its equivalent, from a college or university accredited by an accepted accredited body
- Minimum GPA of 3.00 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- Online application through the Graduate School's application system
- Statement of purpose
- Unofficial transcripts of all college course work attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Certificate Requirements

Required Courses (9 credit hours)

READ 6204 - Teaching Reading to English Language Learners (3)
READ 6252 - K-12 Writing Development and Instruction (3)
READ 6260 - Diagnostic Assessment and Instruction in Reading (3)

Elective Courses (3 credit hours)

Select one of the following:

READ 6250 - Emergent and Elementary Literacy (3)
READ 6255 - Middle/Secondary Reading and Writing (3)

Certificate Total = 12 Credit Hours

Grade Requirements

Students must maintain satisfactory grades and must maintain satisfactory progress toward the certificate. Students are expected to achieve a commendable or satisfactory grade (A or B) in all coursework attempted for graduate credit. An accumulation of three marginal C grades in any graduate coursework will result in suspension of the student's enrollment.

SPECIAL EDUCATION

- Ph.D. in Special Education
- M.Ed. in Special Education and Child Development
  - Academically or Intellectually Gifted (AIG)
  - Applied Behavior Analysis
  - Child and Family Studies
  - Special Education
- M.A.T. in Special Education
  - General Curriculum
  - Adapted Curriculum
- Graduate Certificate in Academically or Intellectually Gifted (AIG)
- Graduate Certificate in Autism Spectrum Disorder (ASD)
- Graduate Certificate in Special Education
  - General Curriculum
  - Adapted Curriculum

Department of Special Education and Child Development

spcd.charlotte.edu

Ph.D. in Special Education

The doctoral program at UNC Charlotte prepares special educators as collaborators, teachers, leaders, and researchers whose work contributes to enhancing the quality of life of individuals who are exceptional learners and their families. Students specialize in high or low incidence disabilities or in the Academically or Intellectually Gifted (AIG). This program offers graduates the widest array of career options and provides the solid research foundation needed for the rapidly changing field of special education. Potential employment for program graduates includes leadership positions in schools and agencies and faculty positions in higher education as teacher trainers/researchers.

The program builds on the Master of Education in Special Education or a comparable program. Applicants who wish to focus on AIG may have a Master's degree in other areas of education with additional coursework in gifted education. The 59-credit Ph.D. program includes 14 credit hours in doctoral seminars in special education, 12 credit hours in research and practice (field work and writing courses), 15 credit hours in research, 15 credit hours of an individually designed specialty, and a dissertation. Additional coursework may be required for students who do not have a Master's degree or licensure in Special Education or AIG; whose master's program was not comparable to UNC Charlotte's; or whose Master's coursework is outdated.

The program will accept up to two courses as transfer from a doctoral-granting college or university accredited by an accepted accrediting body, providing the Special Education Doctoral Committee determines that the course or courses to be transferred are equivalent to similar courses required in the UNC Charlotte Special Education Ph.D. program or fit the specialty area. The grade in these transfer courses must be an A or B. Transfer credits cannot replace the four core doctoral seminars in special education, and all of the dissertation work must be completed at UNC Charlotte.

Students are admitted for either full-time study or intensive part-time study and begin in the Fall semester. Students must complete their degree, including the dissertation, within nine years. The minimum time for completion for a full-time student is 3 years. Full-time students must meet benchmark requirements each year to maintain their status as a doctoral student. Part-time students also must meet benchmark requirements that occur approximately every two years. These benchmarks are intended to help students achieve their goal of completing the doctorate in a timely manner.

Admission Requirements

Applications for admission will be accepted once a year to begin doctoral studies in the fall semester and must be submitted to the Graduate Admissions Office by December 1.

The following documents must be submitted in support of the application:

1) One official transcript of all academic work attempted since high school indicating a GPA of 3.5 (on a scale of 4.0) in a graduate degree program.*
2) Official report of score on the GRE or MAT that is no more than 5 years old.*
3) At least three references* of someone who knows the applicant's current work and/or academic achievements in previous degree work.
4) A two page essay describing prior experiences with individuals with exceptionalities and objectives for pursuing doctoral studies.*
5) A current resume or vita.
6) A professional writing sample (e.g., published article, manuscript submitted for publication, term paper submitted in prior coursework, abstract of thesis, teaching manual).
7) Documentation of teaching and other field experience (e.g., copy of teaching evaluation or letter of recommendation from supervisor and licensure in special education or AIG certificate

8) An interview with the program faculty.
9) International students must submit official and acceptable English language proficiency test scores on the Test of English as a Foreign Language (TOEFL), the Michigan English Language Assessment Battery (MELAB), or the International English Language Testing System (IELTS). All tests must have been taken within the past two years.**

**These items are required of applicants to any of UNC Charlotte' s doctoral programs.*
***See the Graduate School's website for minimum acceptable scores.*

Degree Requirements

Doctoral Seminars in Special Education (14 credit hours)
SPED 8671 - Doctoral Seminar in Special Education Research (3)
SPED 8672 - Doctoral Seminar in Leadership in Special Education (3)
SPED 8673 - Doctoral Seminar in Diversity and Collaboration (3)
SPED 8674 - Doctoral Seminar in Teaching in Special Education (3)
SPED 8699 - Dissertation Proposal Seminar in Special Education (2)

Research and Practice in Special Education (12 credit hours)
Note: The following courses are used in the development of portfolios I and II.
SPED 8471 - Professional Writing in Special Education (2)
SPED 8472 - Research Implementation in Special Education (2)
SPED 8473 - Grant Writing in Special Education (2)
SPED 8474 - Supervision of Student Teachers in Special Education (3)
SPED 8475 - College Teaching in Special Education (3)

Research Courses (15 credit hours + Doctoral Seminar in Research and Dissertation Seminar)
RSCH 8110 - Descriptive and Inferential Statistics (3)
RSCH 8113 - Single-Case Research (3)
RSCH 8120 - Advanced Statistics (3)

Plus select 2 of the following:
RSCH 6130 - Presentation and Computer Analysis of Data (3)
RSCH 8111 - Qualitative Research Methods (3)
RSCH 8112 - Survey Research Methods (3)
RSCH 8140 - Multivariate Statistics (3)
RSCH 8196 - Program Evaluation Methods (3)
SPED 8800 - Independent Study in Special Education (3)

Specialty Courses (15 credit hours)
An individually designed specialty of graduate courses developed by student and advisor. This specialty is typically related to the student's licensure area and may include the following components:

Required Courses (6 credit hours)
SPED 8475 - College Teaching in Special Education (3) *(Co-teaching in three licensure or other courses related to student's specialty) (May be repeated for credit)*
SPED 8675 - Special Education Doctoral Seminar in Applied Behavioral Analysis (3)

Elective Courses (9 credit hours)
Select from the following:
SPED 8475 - College Teaching in Special Education (3) *(May be repeated once for credit)*
SPED 8477 - Teacher Preparation in Online Settings (3)
SPED 8800 - Independent Study in Special Education (1 to 6)

Dissertation (3+ credit hours)
SPED 8999 - Dissertation Credits (3, 6, or 9)

Degree Total = 59 Credit Hours

Additional Degree Requirements

In addition to coursework and the dissertation, students complete a portfolio of achievements related to the four focus areas: leadership, collaboration and diversity, teaching, and research. This portfolio must receive satisfactory ratings from the Portfolio Review Committee at two critical junctures known as Benchmark One and Benchmark Two. The first benchmark serves as a Qualifying Examination and includes demonstration of writing, teaching, and research skills. The second benchmark is comparable to the comprehensive exams required by some Ph.D. programs in Special Education and includes the development of a grant. Students receive opportunities to build this portfolio through the Research and Practice coursework. The following are some of the products in the portfolio: research based paper, journal article review, conference presentation, advocacy project, grant proposal, team study, and research report.

Dissertation Requirements

The purpose of the dissertation is for doctoral students to demonstrate their ability to synthesize the professional literature and generate new knowledge for the profession through using well-established research tools. For the Ph.D. in Special Education, the dissertation may be quantitative (group or single subject) or qualitative research. Whatever type of design, it must adhere to current standards for quality as reflected in professional writing on the chosen method of research design and reflected in the current literature. Students must be continuously enrolled for dissertation research credits through the semester of graduation. Defense of the dissertation is conducted in a final oral examination that is open to the University community.

Application for Degree

Students must submit an online Application for Degree during the semester in which they successfully defend their dissertation proposal. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School.

M.Ed. in Special Education and Child Development

The Master of Education (M.Ed.) in Special Education and Child Development is a professional graduate degree that serves experienced educational professionals who have obtained an undergraduate degree from a college or university accredited by an accepted accredited body and who wish to become collaborative instructional leaders who are knowledgeable, effective, reflective, and responsive to equity and diversity. Upon completion of the 33-credit hour program, graduates who hold an A-Level North Carolina Professional Educator's License may qualify for an M-Level North Carolina Professional Educator's License.

There are four concentrations for the M.Ed. in Special Education and Child Development:

1) Academically or Intellectually Gifted
2) Applied Behavior Analysis
3) Child and Family Studies
4) Special Education

For the Concentration in Academically or Intellectually Gifted (AIG), a bachelor's degree and a Standard Professional 1 (SP1) Professional Educator's License in any content area from North Carolina or its equivalent from another state are required. Individuals already employed in a teaching position where licensure is not required, such as a charter or private school, should hold a bachelor's degree in a related field.

Concentration in Academically or Intellectually Gifted

Admission Requirements

- A bachelor's degree from a a college or university accredited by an accepted accredited body and an A-Level Professional Educator's License in any content area from North Carolina or its equivalent from another state (individuals already employed in a teaching position where licensure is not required, such as a charter or private school, should hold a bachelor's degree in a related field from a college or university accredited by an accepted accredited body)
- Official transcripts of all previous work beyond high school documenting an overall grade point average of at least 3.0 (based on a 4.0 scale)
- Official agency reports of satisfactory Graduate Record Examination (GRE) or the Miller Analogies Test (MAT) test scores (30th percentile or above)
    - Test Score Requirement Waiver: Applicants who previously have received a grade of A in three (if the fourth course is in progress at the time of application) or all four of the four Graduate Certificate courses in Academically or Intellectually Gifted (AIG) at UNC Charlotte may waive the GRE/MAT score requirement. Note: Waiver requests should be sent to the AIG Graduate Program Director.
    - Students who have received one or more course grades below A in UNC Charlotte graduate certificate courses in AIG, or who are applying directly to the M.Ed., are not eligible for this waiver and must provide GRE or MAT scores with their application.
- At least three evaluations from professional educators familiar with the applicant's personal and professional qualifications
- An essay of no more than two pages, describing the applicant's experience and objective in undertaking graduate study in AIG; goals upon completion of the program should be addressed
- A copy of resume, listing the applicant's professional experience
- Apply online at gradadmissions.charlotte.edu

Degree Requirements

Introductory Research Course (3 credit hours)

RSCH 6101 - Research Methods (3)

Phase I Courses: Developing Perspective (15 credit hours)

SPED 5211 - Nature and Needs of Gifted Students (3)
SPED 6124 - Methods of Instructing Gifted Students (3)
SPED 6161 - Social and Emotional Needs of Gifted Students (3)
SPED 6224 - Adapting Curriculum Materials and Classroom Differentiation (3)
RSCH 7111 - Qualitative Research Methods (3)
or another relevant research course approved by advisor (3)

Phase II Courses: Content and Pedagogy (15 credit hours)

SPED 6241 - Advanced Curriculum for Gifted Students (3)
SPED 6270 - Gifted Assessment and Program Evaluation (3)
SPED 6637 - Theory and Development of Creativity (3)
SPED 6695 - Research Proposal in AIG (3)
SPED 6696 - Research Implementation in AIG (3)

Degree Total = 33 Credit Hours

Concentration in Applied Behavior Analysis

Admission Requirements

- A bachelor's degree in special education, psychology, social work, or a related field from a college or university accredited by an accepted accredited body
- Official transcripts of all previous work beyond high school documenting an overall grade point average of at least 3.0 (based on a 4.0 scale)
- Official agency reports of satisfactory Graduate Record Examination (GRE) or the Miller Analogies Test (MAT) test scores (30th percentile or above)
- At least 6 months of documented experience working with individuals with exceptionalities
- At least three evaluations from professional educators familiar with the applicant's personal and professional qualifications
- An essay of no more than two pages describing the applicant's experience and objective in undertaking graduate study in applied behavior analysis
- A copy of resume, listing the applicant's professional experience
- Apply online at gradadmissions.charlotte.edu

Degree Requirements

Introductory Research Course (3 credit hours)

RSCH 6101 - Research Methods (3)

Introductory Concentration Courses (6 credit hours)

SPED 5200 - Concepts and Principles of Behavior Analysis (3)

SPED 5300 - Lifespan Development for Exceptional Individuals (3)

Core Courses (15 credit hours)

SPED 5201 - Science and Philosophy in Behavior Analysis (3)

SPED 5202 - Supervision and Consultation in Behavior Analytic Programming (3)

SPED 5203 - Ethics, Compliance, and Professionalism in Behavior Analysis (3)

SPED 6225 - Behavior Analytic Intervention in Communication (3)

SPED 6502 - Behavioral Assessment (3)

Research Courses (9 credit hours)

RSCH 7113 - Single-Case Research (3)

SPED 6692 - Research Proposal (2)

SPED 6693 - Research Implementation (2)

SPED 6694 - Research Dissemination and Leadership (2)

Degree Total= 33 Credit Hours

Concentration in Child and Family Studies

Admission Requirements

- A bachelor's degree in child and family development, elementary education, special education, or a related field from a college or university accredited by an accepted accrediting body
- Official transcripts of all previous work beyond high school documenting an overall grade point average of at least 3.0 (based on a 4.0 scale)
- Official agency reports of satisfactory Graduate Record Examination (GRE) or the Miller Analogies Test (MAT) test scores (30th percentile or above). Students who have concerns about standardized testing (GRE, MAT) should contact the program director.
- Three letters of recommendation from persons familiar with the applicant's personal or professional qualifications; letters should include a combination of professional, academic, and/or personal
- A personal statement outlining why the applicant seeks admission to the program and describing professional experiences with young children and their families; goals upon the completion of the program should be addressed
- A copy of resume, listing the applicant's professional experience
- Apply online at gradadmissions.charlotte.edu

Degree Requirements

Introductory Research Course (3 credit hours)

RSCH 6101 - Research Methods (3)

Core Courses (15 credit hours)

CHFD 6102 - Learning and Development (3)

CHFD 6115 - Child and Family Advocacy (3)

CHFD 6210 - Inclusive Education for Young Children (3)

CHFD 6220 - Family Theory and Research (3)

CHFD 6240 - Advanced Studies in Infant and Child Development (3)

Applied Research/Evaluation Course (3 credit hours)

CHFD 6900 - Research in Child and Family Studies (Master's Thesis) (3)

Thematic Elective Courses (9 credit hours)

Select elective courses within the EI/ECSE specialty track. Other graduate level courses offered by the Cato College of Education require approval from the advisor.

Early Intervention/Early Childhood Special Education Specialty Track

SPED 6111 - Advanced Issues in Early Intervention/Early Childhood Special Education (EI/ECSE) (3)

SPED 6242 - Enhancing Communication and Supporting Behaviors in Inclusive Settings: B-K (3)

SPED 6350 - Young Children with Disabilities and their Families: Interdisciplinary Collaboration (3)

Leadership Seminar Course (3 credit hours)
CHFD 7400 - Applied Leadership in Child and Family Studies (3)

Degree Total = 33 Credit Hours

Concentration in Special Education

Admission Requirements

- A bachelor's degree with a major in special education from a college or university accredited by an accepted accredited body and an A-Level Professional Educator's License in Special Education from the North Carolina Department of Public Instruction (NCDPI) or its equivalent from another state. Applicants with a bachelor's degree in a field other than special education may be considered for admission if there is clear evidence of substantial, successful experience in teaching in special education.
- Official transcripts of all previous work beyond high school documenting an overall grade point average of at least 3.0 (based on a 4.0 scale)
- Official agency reports of satisfactory Graduate Record Examination (GRE) or the Miller Analogies Test (MAT) test scores (30th percentile or above)
- At least three evaluations from professional educators familiar with the applicant's personal and professional qualifications
- An essay of no more than two pages describing the applicant's experience and objective in undertaking graduate study in special education; goals upon the completion of the program should be addressed
- A copy of resume, listing the applicant's professional experience
- Apply online at gradadmissions.charlotte.edu

Degree Requirements

Introductory Research Course (3 credit hours)
RSCH 6101 - Research Methods (3)

Core Courses (9 credit hours)
EDUC 6254 - Individualizing Instruction for Diverse Learners (3)
SPED 6502 - Behavioral Assessment (3)
SPED 5200 - Concepts and Principles of Behavior Analysis (3)
or SPED 5203 - Ethics, Compliance, and Professionalism in Behavior Analysis (3) *(for candidates who selected the Autism Spectrum Disorder Specialty Track as electives)*

Research Courses (9 credit hours)
RSCH 7113 - Single-Case Research (3)
SPED 6692 - Research Proposal (2)
SPED 6693 - Research Implementation (2)
SPED 6694 - Research Dissemination and Leadership (2)

Specialty Track Courses (12 credit hours)
Select elective courses within a single specialty track or other graduate level courses offered by the Cato College of Education approved by the advisor. The credit hours within the Adapted Curriculum and General Curriculum Specialty Tracks enable candidates to add on an additional North Carolina teaching license in Adapted Curriculum or General Curriculum or upgrade an existing license in either area to the master's level.

Adapted Curriculum Specialty Track
SPED 5274 - General Curriculum Access and Adaptations (3)
SPED 5380 - Multiple Disabilities and Systematic Instruction (3)
SPED 6225 - Behavior Analytic Intervention in Communication (3)
SPED 6800 - Individual Study in Special Education (1 to 6)

Autism Spectrum Disorder Specialty Track
SPED 5200 - Concepts and Principles of Behavior Analysis (3)
SPED 6115 - Introduction to Autism Spectrum Disorder (3)
SPED 6225 - Behavior Analytic Intervention in Communication (3)
SPED 6335 - Evidence-Based Practices for Learners with Autism Spectrum Disorder (3)

General Curriculum Specialty Track
SPED 5372 - Planning Mathematics Instruction for Students with Exceptional Needs (3)
SPED 5375 - Foundations of Literacy for Students with Diverse Learning Needs (3)
SPED 5377 - Advanced Literacy for Students with Diverse Learning Needs (3)
SPED 6800 - Individual Study in Special Education (1 to 6)

Note: Candidates who are interested in pursuing an Exceptional Children (EC) Program Administrator licensure may take three additional courses (beyond the 33-credit hour M.Ed. program). Completion of these courses plus passing of the required PRAXIS tests in conjunction with earning the master's degree can lead to EC Program Administrator licensure through NCDPI.

ADMN 6100 - Fundamentals of Educational Leadership (3)
ADMN 6120 - Instructional Leadership (3)
ADMN 6130 - Supervision of Instruction (3)

Degree Total = 33 Credit Hours

Advising
Upon acceptance into the program, each candidate is assigned a faculty advisor who helps the candidate develop his or her program of study and must approve that program of study. Candidates are expected to meet with their advisor each semester to discuss their coursework and progression toward completion of the degree.

Capstone Experience
The capstone experience is fulfilled by completing a Master's Research Project or Master's Thesis. The nature of the project/thesis is developed by the candidate in consultation with the faculty advisor and presented to the committee for approval. The project is usually something that is practical and useful to the candidate in the professional role that will be assumed upon the completion of the degree. For the Academically and Intellectually Gifted, Applied Behavior Analysis, and Special Education concentrations, candidates will complete a Master's Research Project. For the Child and Family Studies concentration, candidates may either complete a Master's Research Project or a Master's Thesis.

Committee
Each candidate will have a committee of at least two graduate faculty members who will provide guidance through their research project or thesis. Candidates should consult with their academic program advisor in the selection of the committee. For the Child and Family Studies concentration, the following guidelines are intended to assist candidates and advisor(s) in constituting the master's thesis committee.

- *Chair* - selected for content knowledge of the subject area that is chosen for the culminating experience. This person should be from the major department. In addition, the chair must hold a graduate faculty appointment in the department.
- *Second and third members* - selected for knowledge and expertise in the subject area or research expertise (can be external to the department).
- *Technical advisor* - an optional committee member selected for technical support (e.g., specialized skills in program evaluation, technical writing, assessment, curriculum design, graphics, ethnography, and survey research methodology). This person may be, but need not be, from the department.
- *Additional members* - may be added if the committee chair agrees. These members may be from departments of the College other than the candidate's department, or may be from other colleges in the University. Additional members may also be from outside the University with the prior written permission of the Dean of the Graduate School. (This whole process should start at the beginning of the semester prior to graduation. However, the candidate may begin any time after completing 18 credit hours.) For candidates in the CHFS concentration, the committee is formed during CHFD 6900.)

Clinical Field Experiences
Most courses require students to apply the knowledge learned in classes to community-based settings and/or public/private school classrooms. For the AIG concentration, this typically involves video of teaching within one's current classroom assignment. For the Applied Behavior Analysis and Special Education concentrations, students are expected to arrange placement(s) to complete their clinical field experiences in the courses. For the Child and Family Studies concentration, clinical hours can be completed in a variety of professional settings (e.g., current position, different class in the same school, community agencies).

Licensure
A-Level licensure is required for an M-Level license. Successful completion of the master's program leads to recommendation for an M-Level North Carolina Professional Educator's License in Academically or Intellectually Gifted, Birth-Kindergarten (B-K), or Special Education (General Curriculum or Adapted Curriculum), as appropriate to the concentration. Graduates in the Child and Family Studies concentration and the Applied Behavior Analysis concentration who do not hold an A-Level license are not eligible for an advanced licensure. However, candidates in the Applied Behavior Analysis concentration who hold an A-Level Professional Educator's License in Special Education may be eligible for an M-Level license if additional coursework is completed.

Research Opportunities/Experiences
Faculty in the Department of Special Education and Child Development continuously achieve regional, state, and national recognition in scholarship, teaching, and research. As a result, candidates may also have the opportunity to become involved in applied research endeavors. Each candidate will complete a research project or a research thesis.

M.A.T. in Special Education

The Master of Arts in Teaching (M.A.T.) program is designed for individuals who do not already hold a bachelor's degree and/or professional teaching license in Special Education. The M.A.T. program is a 35-credit hour program composed of two phases, the Graduate Certificate phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I of the M.A.T. leads to the North Carolina Standard Professional 1 (SP1) Professional Educator's License in Special Education.

Phase I requires 21 credit hours of coursework, including the graduate internship experience. Upon completion of Phase I, qualified candidates may apply for Phase II to complete the remaining requirements for the Master's degree and qualify for the North Carolina Standard Professional 2 (SP2) Professional Educator's License.

All courses for both phases of the M.A.T. must be completed within seven years. Coursework within Phase I/Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to admission information in the "Graduate School" section of this *Catalog*.

Admission Requirements

Graduate Certificate in Teaching (M.A.T. Phase I Initial licensure only)

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 3.0 *(For alternative ways to demonstrate academic competence, applicants may contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of the applicant's interaction with children or youth
4) A statement of purpose
5) A clear criminal background check
6) Apply online at gradadmissions.charlotte.edu

M.A.T. (Phase II) Program

1) Completion of the Graduate Certificate in Teaching
2) A minimum graduate GPA of 3.5 in the Graduate Certificate in Teaching
3) Students with a GPA below 3.5 in the Graduate Certificate may be considered for admission to the M.A.T. program with scores above the 30th percentile on either the GRE or Millers Analogies Test
4) One recommendation from a full-time faculty member who has taught the applicant in the Graduate Certificate in Teaching program
5) A statement of purpose
6) Apply online at gradadmissions.charlotte.edu

Additional Admission Requirements

In addition to the required application materials, candidates must be currently employed as a teacher, teacher assistant, or have taught within the last two years. Candidates must submit proof of employment along with the required application materials.

Degree Requirements

Phase I: Graduate Certificate (21 credit hours)

Concentrations

Select one of the following concentrations and its requirements:

General Curriculum Concentration Courses (18 credit hours)

SPED 5173 - Diagnostic Assessment (3)
SPED 5300 - Lifespan Development for Exceptional Individuals (3)
SPED 5370 - Culturally Responsive Positive Behavior Support (3)
SPED 5372 - Planning Mathematics Instruction for Students with Exceptional Needs (3)
SPED 5375 - Foundations of Literacy for Students with Diverse Learning Needs (3)
SPED 5400 - Practicum: Integrated Instructional Applications in Special Education (3)

Adapted Curriculum Concentration Courses (18 credit hours)

SPED 5173 - Diagnostic Assessment (3)
SPED 5274 - General Curriculum Access and Adaptations (3)
SPED 5300 - Lifespan Development for Exceptional Individuals (3)
SPED 5370 - Culturally Responsive Positive Behavior Support (3)
SPED 5380 - Multiple Disabilities and Systematic Instruction (3)
SPED 5400 - Practicum: Integrated Instructional Applications in Special Education (3)

Internship/Student Teaching (3-6 credit hours)

An internship is required for Graduate Certificate students. The graduate-level internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. Students are assigned to an appropriate classroom for a full-time semester-long experience under the supervision of the classroom teacher and University faculty. This internship can be done in a student's place of employment or the University can find placement for the student. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the internship experience and licensure requirements. This contact should take place at least one semester before the internship.

Select one of the following:

SPED 6475 - Internship/Seminar: Special Education K-12 - General Curriculum (3 to 6)
SPED 6476 - Internship/Seminar: Special Education K-12 - Adapted Curriculum (3 to 6)

Phase II: Completion of the M.A.T. (14 credit hours)

Common Courses (8 credit hours)

RSCH 7113 - Single-Case Research (3)
SPED 6390 - Collaboration and Transition-Focused Education (2)
SPED 6502 - Behavioral Assessment (3)

Concentration Courses (5 credit hours)

Select one of the following concentrations and its requirements based on the concentration completed during Phase I:

General Curriculum Concentration Courses

SPED 5377 - Advanced Literacy for Students with Diverse Learning Needs (3)
SPED 5379 - Diversity and Disability in the Inclusive Classroom (2)

Adapted Curriculum Concentration Courses

SPED 5371 - Person-Centered Planning within Inclusive Classrooms for Students with Extensive Support Needs (3)
SPED 6225 - Behavior Analytic Intervention in Communication (3)

Capstone Experience (1 credit hour)

The capstone experience for the M.A.T. is fulfilled by completing the evidence project (Data-Based Decision Project) in SPED 6691. Candidates must be employed as a teacher during the semester of taking SPED 6691 or have completed at least one year of successful employment within the two years prior to enrolling in SPED 6691.

SPED 6691 - Seminar in Professional and Leadership Development (1)

Degree Total = 35 Credit Hours

Clinical Field Experiences

Most courses require candidates to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all students learn, including children/youth with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, candidates apply research and/or evidence-based practices gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. *All candidates are expected to complete clinical experiences in at least two significantly different settings.*

Candidates who are residency teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor and may include schools on different schedules, afterschool, summer programs, Saturday programs, and private and charter schools. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Advising

Upon acceptance into the program, all candidates are assigned an advisor. Candidates are expected to meet with their advisor each semester to discuss their coursework.

Licensure

Upon successful completion of the M.A.T. Phase I/Graduate Certificate, candidates are recommended for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. Upon successful completion of the M.A.T. Phase II, candidates are recommended for the North Carolina Standard Professional 2 (SP2) Professional Educator's License.

Graduate Certificate in Special Education

The Graduate Certificate in Special Education is a 21 credit hour program designed for students who do not hold a bachelor's degree in Special Education. Upon successful completion of the Graduate Certificate, students are eligible for the North Carolina Standard Professional 1 (SP1) Professional Educator's License in Adapted or General Curriculum.

The required courses for the Graduate Certificate are identical to Phase I of the M.A.T. Upon completion of the Graduate Certificate, qualified students have the option of continuing into Phase II to complete the M.A.T. Admission to the Graduate Certificate is separate and distinct from admission to a graduate degree program and not an indication of automatic admission to the M.A.T. degree program. For more information on this option, refer to the M.A.T. in Special Education.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to admission information in the "Graduate School" section of this *Catalog*.

Admission Requirements for Graduate Certificate in Teaching Programs

1) An undergraduate degree from a college or university

accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, applicants may contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of the applicant's interaction with children or youth
4) A statement of purpose
5) A clear criminal background check
6) Apply online at graduateschool.charlotte.edu

Certificate Requirements

Concentrations

Select one of the following concentrations and its requirements:

General Curriculum Concentration Courses (18 credit hours)

SPED 5173 - Diagnostic Assessment (3)
SPED 5300 - Lifespan Development for Exceptional Individuals (3)
SPED 5370 - Culturally Responsive Positive Behavior Support (3)
SPED 5372 - Planning Mathematics Instruction for Students with Exceptional Needs (3)
SPED 5375 - Foundations of Literacy for Students with Diverse Learning Needs (3)
SPED 5400 - Practicum: Integrated Instructional Applications in Special Education (3)

Adapted Curriculum Concentration Courses (18 credit hours)

SPED 5173 - Diagnostic Assessment (3)
SPED 5274 - General Curriculum Access and Adaptations (3)
SPED 5300 - Lifespan Development for Exceptional Individuals (3)
SPED 5370 - Culturally Responsive Positive Behavior Support (3)
SPED 5380 - Multiple Disabilities and Systematic Instruction (3)
SPED 5400 - Practicum: Integrated Instructional Applications in Special Education (3)

Internship/Student Teaching (3 credit hours)

An internship is required for Graduate Certificate students. The graduate-level internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. Students are assigned to an appropriate classroom for a full-time semester-long experience under the supervision of the classroom teacher and University faculty. This internship can be done in a student's place of employment or the University can find placement for the student. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the internship experience and licensure requirements. This contact should take place at least one semester before the internship.

SPED 6476 - Internship/Seminar: Special Education K-12 Adapted Curriculum (3 to 6)

Certificate Total = 21 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisor at least once each semester.

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply research and/or evidence-based practices gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. All students are expected to complete clinical experiences in at least two significantly different settings.

Candidates who are residency teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor and may include schools on different schedules, after-school and summer programs, Saturday programs, and private and charter schools. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, students are recommended for the North Carolina Standard Professional 1 (SP1) Professional Educator's License. For this license, students are required to complete an electronic licensure portfolio that is created during coursework and the internship. Students apply for the North Carolina Standard Professional 1 (SP1) Professional Educator's License in the TEAL Office.

Graduate Certificate in Academically or Intellectually Gifted (AIG)

The Graduate Certificate in Academically or Intellectually Gifted (AIG) requires a 12 credit hour sequence of courses and provides a consistent, cohesive structure for teachers seeking to add on the North Carolina Standard Professional 1 (SP1) AIG Professional Educator's license. To be considered for admission to the Graduate Certificate (AIG licensure) Program, applicants must hold or be eligible for a North Carolina teaching license or its equivalent from another state. Applicants will need to hold a teaching position before enrolling in SPED 6124 and SPED 6224 in order to meet course requirements.

Admission Requirements for Graduate Certificate in Teaching Programs

1) A bachelor's degree from a college or university accredited by an accepted accrediting body
2) An Application for Admission to the Graduate School
3) Original transcripts that indicate a minimum overall GPA of at least 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
4) A teaching license from North Carolina or its equivalent from another state
5) Recommendation letters and GRE or MAT scores are not required for applications to the Graduate Certificate in AIG, but are required for admission to the M.Ed. program

Notes: If accepted into the master's degree program, a maximum of twelve (12) Graduate Certificate hours may be applied toward the M.Ed. AIG degree, to elective requirements in other Special Education M.Ed. majors, or to other UNC Charlotte M.Ed. programs, with the permission of the program's Graduate Program Director and the student's academic advisor. Admission to the Graduate Certificate program does not ensure admission into a master's degree program. Applicants must take the GRE or MAT before applying to the Special Education master's degree program in AIG. Applicants who previously have received a grade of A in three (if the fourth course is in progress at the time of application) or all four of the 4 Graduate Certificate courses in AIG at UNC Charlotte may waive the GRE/MAT requirement. Students who have received one or more course grades below A in UNC Charlotte graduate certificate courses in AIG are not eligible for this waiver and must provide GRE or MAT scores with their application to the M.Ed.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Required Course (12 credit hours)

SPED 5211 - Nature and Needs of Gifted Students (3)
SPED 6124 - Methods of Instructing Gifted Students (3)
SPED 6161 - Social and Emotional Needs of Gifted Students (3)
SPED 6224 - Adapting Curriculum Materials and Classroom Differentiation (3)

Certificate Total = 12 Credit Hours

Graduate Certificate in Autism Spectrum Disorder (ASD)

The Graduate Certificate in Autism Spectrum Disorder is a 12-credit hour, non-licensure, online program. It serves two groups of professionals: (1) those who work in school districts and are responsible for teaching individuals with Autism Spectrum Disorder and for developing appropriate individualized education programs that include academic instruction and effective intervention practices in the areas of communication, daily living, and social skills; and (2) those who work in human service agencies and are responsible for providing intervention practices in the areas of communication, daily living, and social skills as well as preparing individuals with Autism Spectrum Disorder to live, work, and learn as adults.

Program Objectives

As specialists in public schools and human service agencies in the area of autism spectrum disorder, completers of the program are prepared to:

- Work as public school teachers in a broad range of educational settings including the general education classroom and special education programs
- Work as human service agency personnel implementing research-validated intervention strategies for children, youth, and adults in community agencies
- Implement research-validated instruction/intervention strategies for children, youth, and young adults with autism spectrum disorder
- Assess the effectiveness of individualized

instruction/intervention programs for individuals with autism spectrum disorder

Admission Requirements for Graduate Certificate in Teaching Programs

- A bachelor's degree in education or a related field of study from a college or university accredited by an accepted accrediting body
- Official transcripts of all previous work beyond high school documenting an overall grade point average of at least 3.0 (based on a 4.0 scale)
- An essay of one to two pages describing the applicant's experience and objective in pursuing the graduate certificate
- Apply online at gradadmissions.charlotte.edu

Applicants to the Graduate Certificate in ASD are not required to take the GRE or MAT. However, individuals who are interested in completing the ASD Graduate Certificate as part of the M.Ed. in Special Education degree must take the GRE or MAT to meet the admissions requirements for the M.Ed. in Special Education. If accepted into the master's degree program, a maximum of twelve (12) Graduate Certificate hours may be applied toward the M.Ed. degree program in Special Education with the permission of the Graduate Program Director. Admission to the Graduate Certificate program does not ensure admission into a master's degree program.

Certificate Requirements

The Graduate Certificate in Autism Spectrum Disorder requires a 12-credit hour sequence of courses. No transfer credit is accepted.

Required Courses (12 credit hours)

SPED 5200 - Concepts and Principles of Behavior Analysis (3)
SPED 6115 - Introduction to Autism Spectrum Disorder (3)
SPED 6225 - Behavior Analytic Intervention in Communication (3)
SPED 6335 - Evidence-Based Practices for Learners with Autism Spectrum Disorder (3)

Certificate Total = 12 Credit Hours

Grade Requirements

Students must earn grades of B or above in each of the courses in the 12-credit hour program of study.

TEACHING ENGLISH AS A SECOND LANGUAGE

- Ph.D. in Curriculum and Instruction*
- M.Ed. in Middle Grades and Secondary Education*
- M.A.T. in English as a Second Language
- Graduate Certificate in Teaching English as a Second Language

**The Ph.D. in Curriculum and Instruction and M.Ed. in Middle and Secondary Grades each offer a Concentration in Teaching English as a Second Language. Information about these related programs can be found under the Curriculum and Instruction heading of this Graduate Catalog.*

Department of Middle, Secondary and K-12 Education

mdsk.charlotte.edu

M.A.T. in English as a Second Language

The Master of Arts in Teaching (M.A.T.) English as a Second Language (ESL) program is designed for individuals with a bachelor's degree (in any area) interested in teaching English Language Learners (ELL) in K-12 public schools. The M.A.T. program is a 30 credit hour program comprised of two phases: the Graduate Certificate phase (Phase I) and the Master's degree completion phase (Phase II). Completion of Phase I (Graduate Certificate) leads to the initial Standard Professional I teaching license in Teaching English as a Second Language (TESL). Phase I requires 18 credit hours of coursework, including a required graduate student teaching/internship experience. Upon completion of Phase I and formal acceptance into the M.A.T. program by the Graduate School, qualified candidates may continue into Phase II to complete the remaining requirements for the Master's degree and qualify for the advanced Standard Professional II teaching license. Applications must be submitted to the Graduate School for formal admission to the Graduate Certificate program in TESL (Phase I). Upon completion of Phase I, another application must be submitted for formal admission to the Master's program (Phase II).

General Requirements for Admission to the Graduate School

Please refer to general information provided in The Graduate School section of this *Catalog.*

Admission Requirements for all M.A.T. Programs

1) Successful completion of the Graduate Certificate in Teaching
2) GRE or Miller Analogies Test scores are required for students with GPAs that do not meet minimum requirements*
3) Three recommendation letters that include at least one from a full-time faculty member who has taught the student in the Graduate Certificate in Teaching English as a Second Language program
4) A statement of purpose (500-1000 words)
5) Apply online at graduateschool.charlotte.edu

There may be additional requirements (at the discretion of the Graduate Program Director) for admittance to the TESL Master's program. The admission process includes timely completion of the Admission to Candidacy form and the Application for Graduation from the Graduate Certificate program.

** Test scores may be waived if students complete the Graduate Certificate in Teaching with a minimum GPA of 3.5.*

Degree Requirements

Phase I: Graduate Certificate Courses (18 credit hours)

Required Courses (15 credit hours)

MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
TESL 5103 - Methods in Teaching English as a Second Language (3)
TESL 5104 - Authentic Assessment (3)
TESL 5204 - Inclusive Classrooms for Immigrant Students (3)
or TESL 6204 - Multicultural Education (3)
TESL 5205 - Second Language Acquisition in K-12 Schools (3)
or ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)

Internship/Student Teaching (3 credit hours)

The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Students are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and university faculty. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place at least one semester before student teaching.

TESL 6470 - Internship in Teaching English as a Second Language (3 to 6) **

*** TESL 6470 is a full-time internship requiring employment as an English as a Second Language teacher in an approved school or a non-paid placement with a licensed ESL teacher in a public school. It requires a formal application and approval during the semester prior to the internship.*

Phase II: Completion of M.A.T. Courses (12 credit hours)

Note: All requirements of Phase I should be completed before beginning Phase II.

Required Courses (9 credit hours)

MDSK 6260 - Teacher Leadership (3)
TESL 6476 - Advanced Pedagogy in Teaching English as a Second Language (3)
TESL 6691 - Seminar in Professional Development (3)
or MDSK 6691 - Seminar in Professional Development (3)s

Elective Course (3 credit hours)

Select one of the following:
ENGL 6161 - Introduction to Linguistics (3)
READ 6204 - Teaching Reading to English Language Learners (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)
An approved Study Abroad program ***
An approved course substitution (3)

**** Written approval for any study abroad experiences and/or elective courses not listed here must be provided in advance by the Graduate Program Director.*

Degree Total = 30 Credit Hours

Advising

All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences

Most courses require students to develop their knowledge, skills, and dispositions in public school/agency settings. All students are expected to complete clinical experiences in at least two significantly diverse settings. Clinical field experiences provide opportunities for helping all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in

coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. All students are expected to complete clinical experiences in at least two different settings. Upon approval from course instructors, these structured experiences can take place in multiple settings such as neighboring schools or districts, day care centers and after-school programs, alternate youth centers, community organizations, non-profit organizations, or in the schools and classrooms in which the candidates work.

Candidates who are lateral entry teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Licensure

Upon successful completion of the Phase I/Graduate Certificate, students are recommended for the North Carolina initial Standard Professional I teaching license. For this initial license, students are required to complete an electronic licensure portfolio that is created during coursework and student teaching. Upon successful completion of Phase II, students are recommended for the North Carolina advanced Standard Professional II teaching license. For the advanced license, students are required to complete an advanced electronic licensure portfolio during coursework.

Graduate Certificate in Teaching English as a Second Language

The Graduate Certificate in Teaching English as a Second Language (TESL) is an 18-credit hour program which includes a required graduate student teaching/internship experience. The Graduate Certificate is designed for students who hold a bachelor's degree and wish to teach English as a Second Language in K-12 settings. Completion of the Graduate Certificate leads to the initial Standard Professional I teaching license in Teaching English as a Second Language.

The required courses for the Graduate Certificate are identical to Phase I of the M.A.T. Upon completion of Phase I and formal acceptance into the M.A.T. program by the Graduate School, qualified candidates may continue into Phase II to complete the remaining requirements for the Master's degree and qualify for the advanced Standard Professional II teaching license. Applications must be submitted to the Graduate School for formal admission to the Graduate Certificate Program in TESL (Phase I).

Upon completion of Phase I, another application must be submitted for formal admission to the Master's program.

Admission to the Graduate Certificate is separate and distinct from admission to a graduate degree program and not an indication of automatic admission to the M.A.T. degree program. For more information on this option, refer to the M.A.T. in Teaching English as a Second Language.

All courses for the Graduate Certificate must be completed within five years.

General Requirements for Admission to the Graduate School

Please refer to general information provided in The Graduate School section of this *Catalog.*

Admission Requirements for all Graduate Certificates in Teaching programs

1) An undergraduate degree from a college or university accredited by an accepted accrediting body
2) A cumulative undergraduate GPA of 2.75 *(For alternative ways to demonstrate academic competence, contact the Office of Teacher Education Advising and Licensure (TEAL))*
3) Three recommendations from persons knowledgeable of your interaction with children or youth
4) Statement of purpose (500-1000 words)
5) Clear criminal background check
6) Apply online at graduateschool.charlotte.edu

Certificate Requirements

Required Courses (15 credit hours)

MDSK 6162 - Planning for K-12 Instruction (2)
MDSK 6162L - Instructional Design Lab (1)
TESL 5103 - Methods in Teaching English as a Second Language (3)
TESL 5104 - Authentic Assessment (3)
TESL 5204 - Inclusive Classrooms for Immigrant Students (3)
or TESL 6204 - Multicultural Education (3)
TESL 5205 - Second Language Acquisition in K-12 Schools (3)
or ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)

Internship/Student Teaching (3 credit hours)

The graduate-level student teaching/internship is the culminating experience of the Graduate Certificate program, offering students the opportunity to demonstrate their readiness for the initial Standard Professional I teaching license. Students are assigned to an appropriate classroom for a full-time, semester-long experience under the supervision of the classroom teacher and university

faculty. Residency teachers and teacher assistants must contact the Office of School and Community Partnerships to determine the appropriateness of their classroom for the student teaching/internship experience and licensure requirements. This contact should take place at least one semester before student teaching.

TESL 6470 - Internship in Teaching English as a Second Language (3 to 6)*

**TESL 6470 is a full-time internship requiring employment as an English as a Second Language teacher in an approved school or a non-paid placement with a licensed ESL teacher in a public school. It required application and approval during the semester prior to the internship.*

Certificate Total = 18 Credit Hours

Advising
All students are assigned an advisor upon formal admission to the program. Students should consult with their advisors at least once each semester.

Clinical Field Experiences
Most courses require students to develop their knowledge, skills, and dispositions in public school settings. These experiences broaden their ability to help all students learn, including children with exceptionalities and students from diverse ethnic/racial, linguistic, gender, and socioeconomic groups. During clinical experiences, students apply theories and understandings gained in coursework, analyze P-12 student learning, and develop the ability to positively impact all learners. All students are expected to complete clinical experiences in at least two significantly diverse settings.

Candidates who are lateral entry teachers and teacher assistants must move beyond their own classrooms and schools for at least two clinical experiences. Alternative settings must be approved by the instructor and may include schools on different schedules, after-school and summer programs, Saturday programs, private, and charter schools. A limited number of clinical experiences may be approved in significantly different classrooms within their school of employment. Employed candidates are encouraged to seek assistance and support from their administrators.

Licensure
Upon successful completion of the Phase I/Graduate Certificate, students will be recommended for the North Carolina initial Standard Professional I teaching license. For this license, students are required to complete an electronic licensure portfolio that is created during coursework and student teaching.

URBAN EDUCATION

- M.Ed. in Urban Education
- Graduate Certificate in Anti-Racism

Department of Middle, Secondary, and K-12 Education
mdsk.charlotte.edu

Department of Reading and Elementary Education
reel.charlotte.edu

M.Ed. in Urban Education

The M.Ed. in Urban Education is a fully online degree program designed to prepare education professionals who are committed to delivering high-quality, culturally relevant/sustaining instruction and services that meet the needs of students in increasingly diverse, urban school systems across the United States. UNC Charlotte is particularly focused on providing professionals with practical tools and resources that increase multicultural competence and awareness. To achieve its objectives, the program aims to equip teachers, administrators, paraprofessionals, counselors, and those alike -- who currently work or aspire to work in, or with, urban schools -- with practical approaches to implementing evidenced-based best practices that improve the educational experiences and academic outcomes of racially, linguistically, socioeconomically, and culturally diverse populations. Students who graduate with an M.Ed. in Urban Education from UNC Charlotte not only gain a pedagogical (instructional) skill set that informs their understanding of culturally responsive/sustaining teaching practices, but they are also trained to recognize and examine larger issues related to culture, race, and racism that influences the quality of non-academic services (counseling, mentoring, social/behavioral support, etc.) prospective graduates may provide to urban communities.

The M.Ed. in Urban Education requires 33 credit hours of coursework. The program is designed as a cohort model that admits students as a group beginning each Fall semester. Students admitted to this selective online program average two (2) courses per semester and are expected to complete the program in two (2) years (including one full Summer term).

Admission Requirements
The minimum admission requirements for the M.Ed. in Urban Education program are:

- An earned undergraduate degree from a college or university accredited by an accepted accrediting body
- An undergraduate GPA of 3.0 or above
- An official transcript of previous academic coursework beyond high school
- Three (3) professional letters of recommendation from education professionals to speak to the benefit of this program for the professional growth of the candidate
- A statement of purpose for entering a M.Ed. in Urban Education online program
- TOEFL scores if applicable (Students for whom English is not the primary language must submit scores from the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS), or Pearson Test of English (PTE))
- Other credentials required by the Graduate School (gradadmissions.charlotte.edu/apply-now/application-requirements)

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Degree Requirements

Required Courses (33 credit hours)

EDCI 6120 - Critical Media Pedagogy and Urban Education (3)
EDCI 6201 - Perspectives in Immigration and Urban Education (3)
EDUC 5100 - Diverse Learners (3)
EDUC 6101 - Culturally Responsive Classroom Management (2 to 3)
ELED 6260 - History and Psychology of Racism (3)
ELED 6261 - Racial Identity (3)
ELED 6262 - Race in Education and Schooling (3)
ELED 6263 - Anti-Racist Activism in Education (3)
MDSK 6691 - Seminar in Professional Development (3)
RSCH 6101 - Research Methods (3)
TESL 6206 - Globalization, Communities, and Schools (3)

Capstone Requirement

All students must submit a professional portfolio as part of MDSK 6691 to meet their capstone requirement.

Grade Requirements

While enrolled in the M.Ed. in Urban Education program, students are expected to earn a grade of A or B in all courses, maintaining a minimum cumulative 3.0 GPA (on a 4.0 scale) to graduate. The capstone project is assessed on a Pass/Unsatisfactory basis and is not included in the cumulative average. An accumulation of three (3) marginal C grades in any graduate coursework results in automatic suspension of enrollment. If students earn a grade of a U in any course, their enrollment is suspended and they are not be able to progress without being readmitted to the program. Readmission to the program requires approval from the Dean of the Graduate School upon the recommendation of the Graduate Program Director.

Degree Total = 33 Credit Hours

Graduate Certificate in Anti-Racism

The Graduate Certificate in Anti-Racism acknowledges the completion of a coherent curriculum that draws from four (4) content courses addressing race and racism in professional or organizational spaces. The Graduate Certificate in Anti-Racism caters to individuals interested in an advanced degree that provides an understanding of education in urban environments with a focus on race, racism, and anti-racism. While the fundamentals of this certificate are rooted in educational systems, drawing on and extending the pedagogical expertise of educators, the programs was strategically designed so these knowledges and skills can disrupt racism in any system, such as politics, housing, public health, healthcare, economics, criminal justice, and beyond. The certificate demonstrates that students have completed coursework enabling them to become justice-oriented change agents in the organizations in which they work.

All coursework is 100% online. The four courses address different foci and content, yet all have the aim that students uncover the underlying social, economic, psychological, and political conditions that disproportionately and inequitably channel advantages and opportunities to particular racialized groups while denying them to others.

Admission Requirements

In general, admission requirements for the Graduate Certificate are:

- A bachelor's degree, or its equivalent, from a a college or university accredited by an accepted accredited body
- GPA of at least 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school).

- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college coursework attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution

Note: Given that certificates are not degree programs and are intended to provide streamlined educational opportunities, standardized test scores (e.g., GRE, GMAT, MAT) are not required for admission.

Certificate Requirements

Required Courses (12 credit hours)

ELED 6260 - History and Psychology of Racism (3)
ELED 6261 - Racial Identity (3)
ELED 6262 - Race in Education and Schooling (3)
ELED 6263 - Anti-Racist Activism in Education (3)

Grade Requirements

A grade of A or B must be received in all courses.

Certificate Total = 12 Credit Hours

The William States Lee College of Engineering

engr.charlotte.edu

The William States Lee College of Engineering at the University of North Carolina at Charlotte is one of the finest engineering colleges in the Southeast. Emphasizing applied research in its educational programs, the college prepares students for careers in engineering through meaningful hands-on involvement and interactive teamwork. Students and faculty work with government, the private sector, and other universities to develop practical advances in technology. Locally and throughout the world, their efforts affect positive economic and environmental change.

With cross-disciplinary expertise and capabilities, UNC Charlotte's renowned engineering research centers provide the tools to tackle real-world challenges in a strong academic environment. The centers, together with the funded research programs of the faculty, support graduate programs in the Departments of Civil and Environmental Engineering, Electrical and Computer Engineering, Engineering Technology and Construction Management, Mechanical Engineering and Engineering Science, and Systems Engineering and Engineering Management.

Civil and Environmental Engineering

Faculty from the Department of Civil and Environmental Engineering focus their research on the built environment and developing resilient and sustainable solutions. These solutions are created through numerical, laboratory, and field-based research. Faculty are active participants in the University's Infrastructure, Design, Environment, and Sustainability Center (IDEAS) and the Center for Advanced Multimodal Mobility Solutions and Education (CAMMSE). The department, in conjunction with the Department of Geography and Earth Sciences, also assumes a key role in the interdisciplinary Infrastructure and Environmental Systems doctoral program.

Electrical and Computer Engineering

The Department of Electrical and Computer Engineering (ECE) offers multidisciplinary programs leading to M.S. and Ph.D. degrees in Electrical and Computer Engineering. Students are provided with breadth of knowledge in electrical and computer engineering and depth of knowledge in their chosen research area. The department is staffed with a prestigious faculty conducting research in various areas that include: communications, networking, signal and image processing, control systems, robotics, embedded systems, computer vision, machine learning, AI, high performance computing, RF systems, metameterials and metasurfaces, ultra low-power electronic devices, optoelectronics, microelectronics, power systems modeling and analysis, power systems stability and control, smart grids and micro-grids, renewable energy, power electronics, and many others. The department has a full range of state-of-the-art laboratories, enabling faculty and students to conduct research at the cutting-edge of technology. ECE faculty are also associated with several interdisciplinary centers such as the Energy Production and Infrastructure Center (EPIC), the Center for Metamaterials (CFM), and the Center for Optoelectronics and Optical Communications.

Engineering Technology and Construction Management

The college offers graduate programs in Applied Energy and Electromechanical Engineering, Construction and

Facilities Engineering, and Fire Protection and Safety Management through the Department of Engineering Technology and Construction Management. These programs focus on applied technology and meet the requirements for expanded education and training in these growing areas of technical importance.

Mechanical Engineering and Engineering Science

The Center for Precision Metrology, under the direction of the Department of Mechanical Engineering and Engineering Science, helps manufacturers in many industries, including automotive, aircraft, and computer manufacturing to produce perfect parts through the aid of state-of-the-art measurement systems. The center's measurement capability ranges from the atomic scale in environmentally controlled laboratories to meter scale parts in the Siemens Energy Large Manufacturing Solutions Laboratory. The department's research programs in computational modeling and the Center for Biomedical Engineering and Science focus on improving the design, control, and manufacturing of engineered and biological systems. The North Carolina Motorsports and Automotive Research Center provides an opportunity to develop systems for the next generation of vehicles as well as providing a platform for development in automotive competition.

Systems Engineering and Engineering Management

The Center for Lean Logistics and Engineered Systems provides industry access to the expertise of the Department of Systems Engineering and Engineering Management faculty assisting them in remaining competitive in global markets. The faculty provide educational opportunities ranging from traditional coursework to continuing education. The offerings span topics from healthcare to energy analytics and industrial systems optimization. The faculty also participates in the Infrastructure and Environmental Systems doctoral program.

Graduate Degree Programs

- Ph.D. in Civil Engineering
- Ph.D. in Electrical Engineering
- Ph.D. in Infrastructure and Environmental Systems *(with the College of Liberal Arts & Sciences)*
- Ph.D. in Mechanical Engineering
- M.S. in Applied Energy and Electromechanical Engineering
- M.S. in Civil Engineering
- M.S. in Computer Engineering
- M.S. in Construction and Facilities Engineering
- M.S. in Electrical Engineering
- M.S. in Engineering
- M.S. in Engineering Management
- M.S. in Fire Protection and Safety Management
- M.S. in Mechanical Engineering
- Graduate Certificate in Applied Energy
- Graduate Certificate in Precision Metrology

CIVIL AND ENVIRONMENTAL ENGINEERING

- Ph.D. in Civil Engineering
  - Environmental and Water Resources Engineering
  - Geo-Environmental Engineering
  - Geotechnical Engineering
  - Structural Engineering
  - Transportation Engineering
- Ph.D. in Infrastructure and Environmental Systems *(see the Infrastructure and Environmental Systems heading)*
- M.S. in Civil Engineering
  - Environmental and Water Resources Engineering
  - Geo-Environmental Engineering
  - Geotechnical Engineering
  - Structural Engineering
  - Transportation Engineering
- M.S. in Engineering
  - Environmental and Water Resources Engineering
  - Geo-Environmental Engineering
  - Geotechnical Engineering
  - Structural Engineering
  - Transportation Engineering

Department of Civil and Environmental Engineering

cee.charlotte.edu

Ph.D. in Civil Engineering

The Department of Civil and Environmental Engineering (CEE) provides opportunities for discipline-specific and multidisciplinary graduate-level and doctoral-level education in Civil and Environmental Engineering and closely related areas. Advanced coursework and capstone research experience are used to enhance professional development, improve technical competency, and engage in a life-long learning experience. CEE has ongoing collaborative research and student exchange programs with several international institutions that add value and further enrich the experience.

The department offers doctoral studies leading to a Civil Engineering Ph.D. degree in five areas of concentration:

1) Environmental Engineering
2) Geo-Environmental Engineering
3) Geotechnical Engineering
4) Structural Engineering
5) Transportation Engineering

Doctoral students engage in courses of study leading to the doctoral degree, becoming competent in selected topics required for completion of research at the doctoral level. During this process, doctoral students acquire knowledge, demonstrate abilities to research on advanced topics in engineering, and communicate technical information effectively. They also discover and create new knowledge, and understand interactions among advanced topics in engineering. The development of such skills helps doctoral students to function and excel professionally.

Doctoral studies leading to the Ph.D. in Infrastructure and Environmental Systems (INES) are available through an interdisciplinary, inter-college program. See the "Infrastructure and Environmental Systems" heading in this section for details.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, CEE seeks the following from applicants to the doctoral program:

Applicants with a Master's Degree in Civil Engineering (Eligible to Pursue the Ph.D. Degree with Advanced Standing)

Doctoral students who hold a relevant master's degree in Civil Engineering or related field, either from UNC Charlotte or another institution, may be eligible to pursue the Ph.D. degree with Advanced Standing. Eligibility for this accelerated option must be made at the time of admission to the program, and is subject to review by the Graduate School. Requirements for admission include:

- An earned master's degree in Civil, Environmental, Structural, or Transportation Engineering, or a closely related Engineering master's degree
- A master's degree GPA of 3.0 or above
- A satisfactory score from the Aptitude Portion of the GRE *(the GRE requirement will be waived for students who are currently enrolled in the MSE/MSCE program at UNC Charlotte, or have completed an MSCE/MSE program at UNC Charlotte)*
- A statement of purpose
- Three letters of recommendation
- An acceptable TOEFL or IELTS score as required by UNC Charlotte for international students. In addition, TOEFL iBT must be a minimum score of 18 on each section of the test while the IELTS must be a minimum score of 6.5 in each section
- Any other appropriate credentials as required by the Graduate School

Applicants with a Bachelor's Degree in Civil Engineering (Eligible to Pursue the Ph.D. Degree)

Doctoral students who hold a bachelor's degree in Civil and/or Environmental Engineering, either from UNC Charlotte or from an ABET-accredited college or university, may be eligible to pursue the Ph.D. degree. Requirements for admission include:

- An earned bachelor's degree in Civil and/or Environmental Engineering from an ABET-accredited college or university
- A bachelor's degree minimum GPA of 3.0
- A satisfactory score from the Aptitude Portion of the GRE
- A statement of purpose
- Three letters of recommendation
- An acceptable TOEFL or IELTS score as required by UNC Charlotte for international students. In addition, TOEFL iBT must be a minimum of score of 18 on each section of the test while the IELTS must be a minimum score of 6.5 in each section
- Any other appropriate credentials as required by the Graduate School

Notes:
Admission for applicants currently in the MSCE program at UNC Charlotte requires a minimum GPA of 3.0, completion of all core courses in their area of concentration, completion of at least 15 credit hours at master's level, and acceptance by the Graduate School to the doctoral program at UNC Charlotte.

Admission for applicants without an undergraduate degree in Civil Engineering requires completion of MSE degree with emphasis in one of the five areas of concentration and GPA of 3.0 or above.

Early Entry Program

Current MSCE students at UNC Charlotte with outstanding academic performance, and satisfying the requirements described above, may be admitted to the Early Entry Program to pursue doctoral study while completing the master's degree requirements. Early Entry doctoral students are dually enrolled with both master's and doctoral status, and may complete up to 15 credit hours toward their doctoral degree prior to graduating with their master's degree.

Application Deadline

Applications for admission must be submitted online directly to the Graduate School. They may be submitted any time prior to April 1 for Fall admission, and October 1 for Spring admission. To be considered for assistantships and tuition grants for the following academic year, potential applicants must apply and submit all required documents by March 1.

Degree Requirements

Requirements for Doctoral Students with a Master's Degree in Civil Engineering (Pursuing the Ph.D. Degree with Advanced Standing)

Under the Advanced Standing option, students must complete 42 credit hours of civil engineering courses, including only 18 credit hours of dissertation research. The remaining 24 credit hours under this option are determined by the student's concentration. With the approval of the doctoral research advisor and Graduate Program Director, a maximum of three doctoral-level courses (outside CEGR or within CEGR) related to the dissertation topic or the student's area of concentration may be incorporated into the credit hour requirement. Note that each doctoral student with Advanced Standing is limited to one individual study class within the 42-credit hour requirement. All doctoral students must also complete GRAD 8302 (Responsible Conduct of Research) and GRAD 8990 (Academic Integrity) as a Graduate School requirement.

Graduate School Required Courses

GRAD 8302 Responsible Conduct of Research (2)
GRAD 8990 Academic Integrity (0)

Concentration Courses (24 credit hours)

Select 24 credit hours from the appropriate concentration:

Environmental Engineering Concentration

CEGR 8090 - Special Topics (3) *(Environmental Engineering topic)*
CEGR 8141 - Water Quality Modeling (3)
CEGR 8142 - Bioenvironmental Engineering (3)
CEGR 8144 - Environmental Biotechnology (3)
CEGR 8146 - Advanced Groundwater Analysis (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8173 - Environmental Aquatic Chemistry (3)
CEGR 8243 - Physical Processes in Environmental Systems (3)
CEGR 8244 - Chemical Fate and Transport (3)
CEGR 8245 - Chemical and Biological Processes in Environmental Systems (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Geo-Environmental Engineering Concentration

CEGR 8090 - Special Topics (3) *(Geo-Environmental Engineering topic)*
CEGR 8146 - Advanced Groundwater Analysis (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8243 - Physical Processes in Environmental Systems (3)
CEGR 8244 - Chemical Fate and Transport (3)
CEGR 8245 - Chemical and Biological Processes in Environmental Systems (3)
CEGR 8251 - Foundation Engineering (3)
CEGR 8252 - Soil Dynamics and Earthquake Engineering (3)
CEGR 8254 - Experimental Soil Mechanics (3)

CEGR 8255 - Slope Stability and Earth Structures (3)
CEGR 8268 - Advanced Soil Mechanics (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Geotechnical Engineering Concentration
CEGR 8090 - Special Topics (3) *(Geotechnical Engineering topic)*
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8251 - Foundation Engineering (3)
CEGR 8252 - Soil Dynamics and Earthquake Engineering (3)
CEGR 8254 - Experimental Soil Mechanics (3)
CEGR 8255 - Slope Stability and Earth Structures (3)
CEGR 8268 - Advanced Soil Mechanics (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Structural Engineering Concentration
CEGR 8090 - Special Topics (3) *(Structural Engineering topic)*
CEGR 8124 - Masonry Design (3)
CEGR 8125 - Structural Strengthening (3)
CEGR 8126 - Analysis of Plates and Shells (3)
CEGR 8127 - Fracture Mechanics and Fatigue (3)
CEGR 8128 - Structural Optimization (3)
CEGR 8129 - Structural Dynamics (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8222 - Experimental Structural Mechanics and Nondestructive Evaluation (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)
MEGR 8141 - Theory of Elasticity I (3)

Transportation Engineering Concentration
CEGR 8090 - Special Topics (3) *(Transportation Engineering topic)*
CEGR 8161 - Traffic Control and Operation (3)
CEGR 8162 - Computer Applications for Transportation Engineers (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8164 - Traffic Safety (3)
CEGR 8166 - Urban Transportation Networks: Operations and Optimization (3)
CEGR 8167 - Discrete Choice Modeling (3)
CEGR 8181 - Traffic Flow Theory (3)
CEGR 8182 - Transportation Systems Analysis (3)
CEGR 8261 - Traffic Signal Control Systems (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Dissertation Research Course (18 credit hours)
The following course must be repeated for a total and maximum of 18 credit hours:

CEGR 8991 - Doctoral Dissertation (1 to 6)

Degree Total = 42 Credit Hours

Requirements for Doctoral Students with a Bachelor's Degree in Civil Engineering (Pursuing the Ph.D. Degree)
Under this option, students must complete 72 credit hours of civil engineering courses, including only 18 credit hours of dissertation research. The remaining 54 credit hours under this option are determined by the student's concentration. At least 39 credit hours of these remaining requirements must be in courses numbered 8000 or above. With the approval of the doctoral research advisor and Graduate Program Director, a maximum of three doctoral-level courses (outside CEGR or within CEGR) related to the dissertation topic or the student's area of concentration may be incorporated into the credit hour requirement. Note that each doctoral student is limited to two individual study classes within the 72-credit hour requirement. All doctoral students must also complete GRAD 8302 (Responsible Conduct of Research) and GRAD 8990 (Academic Integrity) as a Graduate School requirement.

Graduate School Required Courses
GRAD 8302 - Responsible Conduct of Research (2)
GRAD 8990 - Academic Integrity (0)

Concentration Courses (54 credit hours)
Select 54 credit hours from the appropriate concentration:

Environmental Engineering Concentration
Required Courses
CEGR 8243 - Physical Processes in Environmental Systems (3)
CEGR 8245 - Chemical and Biological Processes in Environmental Systems (3)

Elective Courses
CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(Environmental Engineering topic)*
CEGR 5141 - Process Engineering (3)
CEGR 5142 - Water Treatment Engineering (3)
CEGR 5143 - Solid Waste Management (3)
CEGR 5144 - Engineering Hydrology (3)
CEGR 5145 - Groundwater Resources Engineering (3)
CEGR 5146 - Advanced Engineering Hydraulics (3)
CEGR 5147 - Stormwater Management (3)
CEGR 5234 - Hazardous Waste Management (3)
CEGR 5235 - Industrial Pollution Control (3)
CEGR 5237 - Environmental Risk Management (3)
CEGR 5241 - Chemical Processes in Water and Wastewater Treatment (3)
CEGR 5242 - Wastewater Treatment Plant Design (3)
CEGR 5243 - Topics in Environmental Health (3)
CEGR 5247 - Sustainability (3)
CEGR 8090 - Special Topics (3) *(Environmental Engineering topic)*
CEGR 8141 - Water Quality Modeling (3)

CEGR 8142 - Bioenvironmental Engineering (3)
CEGR 8144 - Environmental Biotechnology (3)
CEGR 8146 - Advanced Groundwater Analysis (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8173 - Environmental Aquatic Chemistry (3)
CEGR 8244 - Chemical Fate and Transport (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Geo-Environmental Engineering Concentration

Required Courses
CEGR 5145 - Groundwater Resources Engineering (3)
CEGR 5264 - Landfill Design and Site Remediation (3)

Elective Courses
CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(Geo-Environmental Engineering topic)*
CEGR 5264 - Landfill Design and Site Remediation (3)
CEGR 5270 - Earth Pressures and Retaining Structures (3)
CEGR 5271 - Pavement Design (3)
CEGR 5272 - Design with Geosynthetics (3)
CEGR 5273 - Engineering Ground Improvement (3)
CEGR 5274 - Site Characterization (3)
CEGR 5278 - Geotechnical Engineering II (3)
CEGR 8090 - Special Topics (3) *(Geo-Environmental Engineering topic)*
CEGR 8146 - Advanced Groundwater Analysis (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8243 - Physical Processes in Environmental Systems (3)
CEGR 8244 - Chemical Fate and Transport (3)
CEGR 8245 - Chemical and Biological Processes in Environmental Systems (3)
CEGR 8251 - Foundation Engineering (3)
CEGR 8252 - Soil Dynamics and Earthquake Engineering (3)
CEGR 8254 - Experimental Soil Mechanics (3)
CEGR 8255 - Slope Stability and Earth Structures (3)
CEGR 8268 - Advanced Soil Mechanics (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Geotechnical Engineering Concentration

Required Courses
CEGR 5270 - Earth Pressures and Retaining Structures (3)
CEGR 8251 - Foundation Engineering (3)
CEGR 8254 - Experimental Soil Mechanics (3)
CEGR 8255 - Slope Stability and Earth Structures (3)
CEGR 8268 - Advanced Soil Mechanics (3)

Elective Courses
CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(Geotechnical Engineering topic)*
CEGR 5145 - Groundwater Resources Engineering (3)
CEGR 5264 - Landfill Design and Site Remediation (3)
CEGR 5271 - Pavement Design (3)
CEGR 5272 - Design with Geosynthetics (3)
CEGR 5273 - Engineering Ground Improvement (3)
CEGR 5274 - Site Characterization (3)
CEGR 5278 - Geotechnical Engineering II (3)
CEGR 8090 - Special Topics (3) *(Geotechnical Engineering topic)*
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8251 - Foundation Engineering (3)
CEGR 8252 - Soil Dynamics and Earthquake Engineering (3)
CEGR 8254 - Experimental Soil Mechanics (3)
CEGR 8255 - Slope Stability and Earth Structures (3)
CEGR 8268 - Advanced Soil Mechanics (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Structural Engineering Concentration

Required Courses
CEGR 5108 - Finite Element Analysis and Applications (3)
CEGR 5222 - Structural Steel Design II (3)
CEGR 5224 - Advanced Structural Analysis (3)
CEGR 5226 - Reinforced Concrete Design II (3)
CEGR 8129 - Structural Dynamics (3)

Elective Courses
CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(Structural Engineering topic)*
CEGR 5121 - Prestressed Concrete Design (3)
CEGR 5123 - Bridge Design (3)
CEGR 5125 - Forensic Engineering (3)
CEGR 5126 - Codes, Loads, and Nodes (3)
CEGR 5127 - Green Building and Integrative Design (3)
CEGR 5128 - Matrix Methods of Structural Analysis (3)
CEGR 5223 - Timber Design (3)
CEGR 8090 - Special Topics (3) *(Structural Engineering topic)*
CEGR 8124 - Masonry Design (3)
CEGR 8125 - Structural Strengthening (3)
CEGR 8126 - Analysis of Plates and Shells (3)
CEGR 8127 - Fracture Mechanics and Fatigue (3)
CEGR 8128 - Structural Optimization (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8222 - Experimental Structural Mechanics and Nondestructive Evaluation (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)
MEGR 8141 - Theory of Elasticity I (3)

Transportation Engineering Concentration

Required Courses
CEGR 5161 - Advanced Traffic Engineering (3)
CEGR 5162 - Transportation Planning (3)
CEGR 5185 - Geometric Design of Highways (3)
CEGR 8161 - Traffic Control and Operation (3)

Elective Courses
CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(Transportation Engineering topic)*
CEGR 5171 - Urban Public Transportation (3)
CEGR 5181 - Human Factors in Traffic Engineering (3)

CEGR 5182 - Transportation Environmental Assessment (3)
CEGR 5183 - Traffic Engineering Studies (3)
CEGR 5262 - Traffic Engineering (3)
CEGR 5271 - Pavement Design (3)
CEGR 8090 - Special Topics (3) *(Transportation Engineering topic)*
CEGR 8162 - Computer Applications for Transportation Engineers (3)
CEGR 8163 - GIS for Civil Engineers (3)
CEGR 8164 - Traffic Safety (3)
CEGR 8166 - Urban Transportation Networks: Operations and Optimization (3)
CEGR 8167 - Discrete Choice Modeling (3)
CEGR 8181 - Traffic Flow Theory (3)
CEGR 8182 - Transportation Systems Analysis (3)
CEGR 8261 - Traffic Signal Control Systems (3)
CEGR 8892 - Individualized Study (3)
CEGR 8893 - Research Methods (3)

Dissertation Research Course (18 credit hours)
The following course must be repeated for a total and maximum of 18 credit hours:

CEGR 8991 - Doctoral Dissertation (1 to 6)

Degree Total = 72 Credit Hours

Advising

Each student admitted to the doctoral program will be assigned an initial academic advisor. Within the first year (prior to completion of the second semester) in the doctoral program, each student selects a permanent doctoral research advisor. This selection must be approved by the Program Director and Dean of the Graduate School.

At any time, a doctoral student may request a change in initial academic advisor or doctoral research advisor. These requests must be submitted to the Program Director in writing for consideration and action.
Assistantships

Teaching assistantships are available from CEE on a competitive basis to highly qualified applicants. Interested applicants are encouraged to directly contact faculty in their area of interest for research assistantships.
Tuition Grants

Tuition grants including Non-Resident Tuition Differentials and Resident Tuition Aids are available on a competitive basis for both out-of-state and in-state doctoral students, respectively.

Doctoral Committee

Each student's doctoral committee will contain at least four members. One committee position will be filled by a UNC Charlotte Graduate Faculty Representative appointed by the Dean of the Graduate School. The remaining three members are recommended, before the completion of the student's first year in the doctoral program, by the student's doctoral research advisor, with input from the Graduate Program Director. The Program Director approves, with subsequent concurrence by the Dean of the Graduate School, the three recommended faculty members to serve on the doctoral committee. The doctoral committee of each student is chaired by the student's doctoral research advisor.

At least one doctoral committee member must be an expert and CEE faculty member in the student's area of concentration. The inclusion of one member from outside the area of concentration or CEE is strongly encouraged, and this person must also be a member of the UNC Charlotte Graduate Faculty.

Qualifying Examination

Each doctoral student with Advanced Standing must take and pass a qualifying exam before the end of the 4th semester from joining the doctoral program, while each doctoral student without a master's degree must take and pass a qualifying exam before the end of the 6th semester from joining the doctoral program. The written qualifying exam should cover at least four courses in the area of concentration, and is administered by the student's doctoral research advisor and doctoral committee. The written qualifying exam may be followed by an oral qualifying exam, administered by the student's doctoral research advisor and doctoral committee.

Doctoral students with Advanced Standing, who have completed at least 18 credit hours of coursework and have at least a 3.0 GPA, are eligible to take the written qualifying exam. Doctoral students without a master's degree, who have completed at least 48 credit hours of coursework and have at least a 3.0 GPA, are also eligible to take the written qualifying exam. A doctoral student may attempt to pass the qualifying exam no more than twice. Failure to pass the written qualifying exam in two attempts or before the end of the specified semester will result in termination of enrollment in the doctoral program. Doctoral students who do not take the qualifying exam before the end of the specified semester but are terminated from the doctoral program may appeal to be reinstated back into the doctoral program by submitting an acceptable plan to take and pass the qualifying exam.

Advancement to Candidacy

After passing the qualifying examination, a student must propose a dissertation topic, prepare a written proposal, and submit it to the doctoral committee for review at least two weeks before the oral exam date. The oral exam, administered by the student's doctoral research advisor and doctoral committee, includes a presentation and

defense by the student of his or her proposed research topic in a forum open to the public. This oral exam should be successfully completed before the end of the 5th semester from joining the doctoral program by doctoral students with Advanced Standing, and, before the end of the 8th semester from joining the doctoral program by doctoral students without a master's degree. The doctoral student advances to candidacy after the dissertation topic and proposal has been approved by the student's doctoral committee. The candidacy must be achieved at least 6 months before the doctoral degree is conferred.
Dissertation

The doctoral program includes a minimum of 18 credit hours of dissertation. Each doctoral student must complete and defend a dissertation based on a research program approved by the student's doctoral committee. The dissertation must be of high quality and represent an original piece of research that advances the body of knowledge in the area of concentration. The oral presentation and successful defense of the dissertation before the student's doctoral committee in a forum open to the public is required. A copy of the student's dissertation will be made available to the doctoral committee at least two weeks prior to the public defense. The dissertation must be written in a format acceptable to the Graduate School and shall satisfy all requirements and deadlines specified by the UNC Charlotte Graduate School. Details pertaining to required actions for the dissertation are available from the department and Graduate Program Director.

Dissertation

The doctoral program includes a minimum of 18 credit hours of dissertation. Each doctoral student must complete and defend a dissertation based on a research program approved by the student's doctoral committee. The dissertation must be of high quality and represent an original piece of research that advances the body of knowledge in the area of concentration. The oral presentation and successful defense of the dissertation before the student's doctoral committee in a forum open to the public is required. A copy of the student's dissertation will be made available to the doctoral committee at least two weeks prior to the public defense. The dissertation must be written in a format acceptable to the Graduate School and shall satisfy all requirements and deadlines specified by the UNC Charlotte Graduate School. Details pertaining to required actions for the dissertation are available from the department and Graduate Program Director.

Application for Degree

Each student should apply for their doctoral degree by completing the online Application for Degree through DegreeWorks no later than the filing date specified in the UNC Charlotte Academic Calendar.

Time Limit

Students are allowed a maximum of eight (8) calendar years from formal admission to the doctoral program to complete the program successfully.

Transfer Credit

CEE accepts the transfer of related doctoral level courses (6 credit hours maximum) taken at another institution or from UNC Charlotte prior to admission to the doctoral program in Civil Engineering. These courses must be part of the recommended list of courses in the doctoral student's area of concentration. Further, these credit hours cannot be counted toward another degree.

Research Opportunity/Experience

CEE doctoral students enjoy a curriculum with opportunities for interdisciplinary research, study abroad, and active participation in a growing research program. Programs of study can be tailored to suit individual needs and interests. The CEE website provides current areas of research conducted by the faculty.

Assistantships

Teaching assistantships are available from CEE on a competitive basis to highly qualified applicants. Interested applicants are encouraged to directly contact faculty in their area of interest for research assistantships.

Research Opportunity/Experience

CEE doctoral students enjoy a curriculum with opportunities for interdisciplinary research, study abroad, and active participation in a growing research program. Programs of study can be tailored to suit individual needs and interests. The CEE website provides current areas of research conducted by the faculty.

Tuition Grants

Tuition grants including Non-Resident Tuition Differentials and Resident Tuition Aids are available on a competitive basis for both out-of-state and in-state doctoral students, respectively.

M.S. in Civil Engineering (MSCE) or M.S. in Engineering (MSE)

The M.S.C.E. program requires a baccalaureate degree in Civil and Environmental Engineering. The M.S.E. degree offers a more discipline-specific program of study to students who may not possess a baccalaureate degree in Civil and Environmental Engineering.

The Department of Civil and Environmental Engineering offers graduate studies leading to a master's degree

(M.S.C.E. or M.S.E.) in five areas of concentration:

1) Environmental and Water Resources Engineering
2) Geo-Environmental Engineering
3) Geotechnical Engineering
4) Structural Engineering
5) Transportation Engineering

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the Department of Civil and Environmental Engineering seeks the following from applicants to the Master's programs in Civil Engineering:

- An earned undergraduate degree in Civil Engineering for the MSCE master's program or a closely related field for the MSE master's program
- An undergraduate GPA of 3.0 or better
- A satisfactory score from the Aptitude Portion of the GRE *(the GRE requirement is waived for: (1) current UNC Charlotte CEE undergraduate students who have earned a minimum 3.2 cumulative GPA and completed at least 75 earned credit hours and (2) applicants who have graduated from UNC Charlotte)*
- Three letters of recommendation
- An acceptable TOEFL score as required by UNC Charlotte for international students
- And any other appropriate credentials as required by the Graduate School
- Remediation of certain deficiencies as specified by the department for each area of concentration

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the Undergraduate Catalog for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the Graduate Catalog for more information about Accelerated Master's Programs.

Application Deadline

Applications for admission must be submitted online directly to the Graduate School. They may be submitted any time prior April 1 for Fall admission, and October 1 for Spring admission. To be considered for assistantships and tuition grants for the following academic year, students should apply by February 15 because the Department makes the first round of award decisions by March 15.

Degree Requirements

A minimum of 30 approved graduate credit hours is required for graduation. At least half of the approved graduate credit hours must be in courses numbered 6000 or above. A student may fulfill the 30-hour requirement by pursuing one of the three study options: (a) 24 hours of coursework plus 6 hours of thesis, (b) 27 hours of coursework plus 3 hours of a directed project, or (c) 30 hours of coursework and a comprehensive examination. Each student is limited to one individual study class within the 30 credit hour requirement.

Concentration Courses

Required core courses for the five concentrations are listed below.

Environmental and Water Resources Engineering Concentration

CEGR 6243 - Physical Processes in Environmental Systems (3)
CEGR 6245 - Chemical and Biological Processes in Environmental Systems (3)

Geo-Environmental Engineering Concentration

CEGR 5145 - Groundwater Resources Engineering (3) -
CEGR 5264 - Landfill Design and Site Remediation (3)

Geotechnical Engineering Concentration

CEGR 5270 - Earth Pressures and Retaining Structures (3)
CEGR 6251 - Foundation Engineering (3)
CEGR 6254 - Experimental Soil Mechanics (3)
CEGR 6255 - Slope Stability and Earth Structures (3)
CEGR 6268 - Advanced Soil Mechanics (3) -

Structural Engineering Concentration

CEGR 5108 - Finite Element Analysis and Applications (3)
CEGR 5222 - Structural Steel Design II (3)
CEGR 5224 - Advanced Structural Analysis (3)
CEGR 5226 - Reinforced Concrete Design II (3)
CEGR 6129 - Structural Dynamics (3)

Transportation Engineering Concentration

CEGR 5161 - Advanced Traffic Engineering (3)
CEGR 5162 - Transportation Planning (3)
CEGR 5185 - Geometric Design of Highways (3)
CEGR 6161 - Traffic Control and Operation (3)
GEOG 6100 - Quantitative Methods in Geography (3)

Additional Recommended Courses

Additional recommended courses (excluding CEGR 6891, CEGR 6892, and CEGR 6991) for each concentration are

listed below.

Environmental and Water Resources Engineering Concentration

CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(environmental and water resources engineering topic)*
CEGR 5141 - Process Engineering (3)
CEGR 5142 - Water Treatment Engineering (3)
CEGR 5143 - Solid Waste Management (3)
CEGR 5144 - Engineering Hydrology (3)
CEGR 5145 - Groundwater Resources Engineering (3)
CEGR 5146 - Advanced Engineering Hydraulics (3)
CEGR 5147 - Stormwater Management (3)
CEGR 5234 - Hazardous Waste Management (3)
CEGR 5235 - Industrial Pollution Control (3)
CEGR 5237 - Environmental Risk Management (3)
CEGR 5241 - Chemical Processes in Water and Wastewater Treatment (3)
CEGR 5242 - Wastewater Treatment Plant Design (3)
CEGR 5243 - Topics in Environmental Health (3)
CEGR 5247 - Sustainability (3)
CEGR 6090 - Special Topics in Civil Engineering (1 to 6) *(environmental and water resources engineering topic)*
CEGR 6141 - Water Quality Modeling (3)
CEGR 6142 - Bioenvironmental Engineering (3)
CEGR 6144 - Environmental Biotechnology (3)
CEGR 6145 - Waste Incineration (3)
CEGR 6146 - Advanced Groundwater Analysis (3)
CEGR 6147 - Watershed Modeling (3)
CEGR 6148 - Water Conservation (3)
CEGR 6149 - Watershed Analysis (3)
CEGR 6171 - Air Quality Control (3)
CEGR 6172 - Air Dispersion Modeling (3)
CEGR 6173 - Environmental Aquatic Chemistry (3)
CEGR 6244 - Chemical Fate and Transport (3)

Geo-Environmental Engineering Concentration

CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(geo-environmental engineering topic)*
CEGR 5270 - Earth Pressures and Retaining Structures (3)
CEGR 5271 - Pavement Design (3)
CEGR 5272 - Design with Geosynthetics (3)
CEGR 5273 - Engineering Ground Improvement (3)
CEGR 5274 - Site Characterization (3)
CEGR 5278 - Geotechnical Engineering II (3)
CEGR 6146 - Advanced Groundwater Analysis (3)
CEGR 6243 - Physical Processes in Environmental Systems (3)
CEGR 6244 - Chemical Fate and Transport (3)
CEGR 6245 - Chemical and Biological Processes in Environmental Systems (3)
CEGR 6251 - Foundation Engineering (3)
CEGR 6252 - Soil Dynamics and Earthquake Engineering (3)
CEGR 6254 - Experimental Soil Mechanics (3)
CEGR 6255 - Slope Stability and Earth Structures (3)
CEGR 6268 - Advanced Soil Mechanics (3)

Geotechnical Engineering Concentration

CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(geotechnical engineering topic)*
CEGR 5145 - Groundwater Resources Engineering (3)
CEGR 5264 - Landfill Design and Site Remediation (3)
CEGR 5271 - Pavement Design (3)
CEGR 5272 - Design with Geosynthetics (3)
CEGR 5273 - Engineering Ground Improvement (3)
CEGR 5274 - Site Characterization (3)
CEGR 5278 - Geotechnical Engineering II (3)
CEGR 6252 - Soil Dynamics and Earthquake Engineering (3)

Structural Engineering Concentration

CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(structural engineering topic)*
CEGR 5121 - Prestressed Concrete Design (3)
CEGR 5123 - Bridge Design (3)
CEGR 5125 - Forensic Engineering (3)
CEGR 5126 - Codes, Loads, and Nodes (3)
CEGR 5127 - Green Building and Integrative Design (3)
CEGR 5128 - Matrix Methods of Structural Analysis (3)
CEGR 5223 - Timber Design (3)
CEGR 6090 - Special Topics in Civil Engineering (1 to 6) *(structural engineering topic)*
CEGR 6122 - Advanced Topics in Structural Steel (3)
CEGR 6124 - Masonry Design (3)
CEGR 6125 - Structural Strengthening (3)
CEGR 6126 - Analysis of Plates and Shells (3)
CEGR 6127 - Fracture Mechanics and Fatigue (3)
CEGR 6128 - Structural Optimization (3)
CEGR 6222 - Experimental Structural Mechanics and Nondestructive Evaluation (3)
MEGR 6141 - Theory of Elasticity I (3)

Transportation Engineering Concentration

CEGR 5090 - Special Topics in Civil Engineering (1 to 4) *(transportation engineering topic)*
CEGR 5171 - Urban Public Transportation (3)
CEGR 5181 - Human Factors in Traffic Engineering (3)
CEGR 5182 - Transportation Environmental Assessment (3)
CEGR 5183 - Traffic Engineering Studies (3)
CEGR 5262 - Traffic Engineering (3)
CEGR 5271 - Pavement Design (3)
CEGR 6090 - Special Topics in Civil Engineering (1 to 6) *(transportation engineering topic)*
CEGR 6162 - Computer Applications for Transportation Engineers (3)
CEGR 6163 - GIS for Civil Engineers (3)
CEGR 6164 - Traffic Safety (3)
CEGR 6165 - Urban Systems Engineering (3)
CEGR 6166 - Urban Transportation Networks: Operations and Optimization (3)
CEGR 6167 - Discrete Choice Modeling (3)
CEGR 6181 - Traffic Flow Theory (3)
CEGR 6182 - Transportation Systems Analysis (3)
CEGR 6261 - Traffic Signal Control Systems (3)

Note: Undergraduate students who have taken any of the courses listed above, or equivalent material, as part of their undergraduate program need not take the corresponding 5000-level graduate courses. Instead, they may choose other graduate courses as part of their master's degree plan of study. Courses without designated course numbers are currently being offered as Special Topic classes with appropriate course numbers yet to be provided.

Elective Courses
With advisor and Graduate Program Director approval, a maximum of one graduate course (outside or within CEGR) related to the thesis topic, project topic, or student's concentration may be incorporated into the 30 credit hour requirement. A student with a non-CEGR background is encouraged to fulfill the 30 credit hour requirement by taking all CEGR courses.

Transfer Credit
The Department accepts the transfer of related graduate courses (6 credit hours maximum) taken at another institution or from UNC Charlotte prior to admission to the master's program in Civil Engineering.

Capstone Experiences
Students pursuing a master's degree in Civil and Environmental Engineering have three options to complete the 30 credit hour program:

1) 24 credit hours of coursework plus 6 credit hours of thesis (CEGR 6991)
2) 27 credit hours of coursework plus 3 credit hours of a directed project (CEGR 6891)
3) 30 credit hours of coursework plus a written and/or oral comprehensive examination

All three options require the formation of a program committee as described below. The thesis and project options require students to submit a written thesis or project report, and orally defend their work before their program committee.

A student's comprehensive exam may be taken once all core courses are completed, and at least 18 credit hours of graduate coursework are either completed or in progress. Core courses taken at the graduate level may be included in the 18 credit hours. Exception requests may be considered if a student has completed all but one of the core courses and is currently enrolled in the final core course of their plan of study. The student's graduate advisor and the examining committee coordinate the examination (typically offered once in the Fall semester, once in the Spring semester, and once in the Summer), preparing the exam with the assistance of members of the student's Program Committee. The exam measures the student's mastery of theories and applications in core courses and/or in the selected area of specialization within the discipline. Students have only two attempts to pass the examination. All students passing the written examination are assessed further on their oral communication effectiveness.

Degree Total = 30 Credit Hours

Application for Degree
Students preparing to graduate must submit an online Application for Degree by the filing date specified in the University Academic Calendar. If a student does not graduate in the semester identified on the Application for Degree, then the student must submit a new Application for Degree for graduation in a subsequent semester.

Advising
Each student is assigned an initial academic advisor. Upon developing a program of study, the student shall be supervised by their graduate advisor and a program committee.

Program Committee
The Program Committee shall consist of at least three UNC Charlotte graduate faculty members. At most one graduate faculty member (CEGR or non-CEGR) from outside the student's concentration may serve as a member of the Program Committee. The student's CEE graduate advisor shall chair the committee.

Research Opportunity/Experience
Students in Civil and Environmental Engineering enjoy a curriculum with opportunities for interdisciplinary research, study abroad, and active participation in a growing research program. Programs of study can be tailored to suit individual needs and interests. The CEE website (cee.charlotte.edu) provides current areas of research conducted by the Civil and Environmental Engineering faculty.

Program Learning Outcomes
Students completing master's degree will demonstrate abilities to analyze and evaluate advanced topics in engineering, and to communicate technical information effectively. Achievement of these outcomes will prepare students to function professionally in their chosen careers.

Program learning outcomes for doctoral students are described in the "Infrastructure and Environmental Systems" section of this *Catalog.*

Assistantships
Research and teaching assistantships are available from the Department on a competitive basis to highly qualified

applicants/students. Interested students are encouraged to directly contact faculty in their area of interest for research assistantships.

Tuition Grants

Tuition grants including Non-Resident Tuition Differentials and Resident Tuition Aids are available on a competitive basis for both out-of-state and in-state students, respectively.

CONSTRUCTION AND FACILITIES ENGINEERING

- M.S. in Construction and Facilities Engineering

Department of Engineering Technology and Construction Management

et.charlotte.edu

M.S. in Construction and Facilities Engineering

Construction Engineering is a program that prepares individuals to manage, coordinate, and supervise the construction process from concept development through project completion on timely and economic bases. Such programs include instruction in commercial, residential, mechanical, highway/heavy civil, electrical, environmental, industrial, and specialty construction; facilities management; project planning; budgeting and cost control; logistics and materials management; personnel management and labor relations; site safety; construction contracting; construction processes and techniques; organization and scheduling; and applicable codes and regulations.

Facility Engineering is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology. The body of knowledge required for facility engineering degree programs includes facility function (professional practice), human and environmental factors, planning and project management, finance, operation and maintenance, real estate, written and oral communication, information technology, quality management and assessment procedures (research and analytical methods), and integrative and problem-solving skills.

Construction and facility engineering professionals work with owners, engineers, architects, specialty and sub-contractors, government agencies, and others to deliver, operate and maintain constructed projects and facilities. This M.S. program provides the advanced professional development and graduate education necessary for construction and facility engineering professionals to work in the increasing high tech, rapidly changing construction industry and related careers such as real estate and land development, infrastructure development, code

enforcement, and insurance. The program also has a special relationship with and focus on sustainability and energy infrastructure as part of the Energy Production and Infrastructure Center (EPIC) and Innovative Design, Engineering, and Sustainability (IDEAS) Center initiatives at UNC Charlotte.

Admission Requirements

The minimum admission requirements for the program are:

- An earned undergraduate degree in construction management, facility management, engineering technology, engineering, architecture, or a closely related field
- An undergraduate GPA of 2.75 or above
- Acceptable scores on the verbal, quantitative, and analytical sections of the GRE
- Positive recommendations
- A combined TOEFL score of 220 (computer-based) or 557 (paper-based) is required if the previous degree was from a country where English is not the common language
- Integral and differential calculus (MATH 1120, MATH 1121, or ETGR 3171 or equivalent)
- Statistics (STAT 1220 or STAT 3128 or equivalent)
- Other credentials as required by the Graduate School

Documents to be Submitted

- Official transcripts from all colleges and universities attended
- Official GRE scores
- Official TOEFL scores
- The UNC Charlotte application for graduate admission online
- Three professional recommendations
- Others as required by the Graduate School

GRE Waiver

The GRE requirement will be waived for the following applicants:

- UNC Charlotte students currently enrolled in engineering technology, construction management, engineering, or architecture
- Applicants having earned a bachelor's degree in engineering or engineering technology from an ABET-accredited program; or a bachelor's degree in construction management, construction science, building construction, or building science from an ACCE accredited program; or a bachelor's degree in architecture from an NCARB accredited program
- Applicants having an earned graduate degree

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Application Deadline

Applications can be received by the Graduate Admission Office any time prior to the published deadlines. In order to be considered for assistantships and tuition grants for the following academic year, students should apply by March 1 for priority consideration. The first round of award decisions typically occurs by March 15. However, the Department will evaluate admission applications at any time complete applications are received by the Graduate School.

Degree Requirements

The program leading to the Master of Science degree in Construction and Facilities Engineering is a 30 credit hour program. The program consists of a 9 credit hour common core and a capstone experience, including either a non-research-focused sequence of 21 credit hours of electives or a research-focused sequence of 15 credit hours of electives with a formal 6 credit hour graduate research thesis and completion of the 3 credit hour CMET 6160 course. At least 15 credit hours must be in courses numbered 6000 or above. The 30 credit hour degree program is outlined below:

Common Core Courses (9 credit hours)

CMET 6135 - Advanced Construction Planning and Management (3)
CMET 6240 - Safety and Risk Management (3)
CMET 6270 - Operation of Constructed Facilities (3)

Elective Courses (21 credit hours)

Select from one of the following sequences:

Master's Thesis and Research Sequence (21 credit hours)

Required Courses (9 credit hours)
CMET 6160 - Research and Analytics Methods (3)
CMET 6900 - Master's Thesis and Research (6)

Elective Courses (12 credit hours)
Select from the following or others with director approval:
CMET 5126 - Project Scheduling and Control (3)
CMET 5135 - Building Information Modeling (3)
CMET 5140 - Building Energy Management (3)
CMET 5150 - Green Building (3)
CMET 5160 - Advanced Construction Materials (3)
CMET 5290 - Temporary Structures in Construction (3)
CMET 5350 - Construction Geotechnics and Foundations (3)
CMET 6000 - Special Topics in Construction and Facility Management (3)
CMET 6145 - Facilities Management Financial Analysis (3)
CMET 6155 - Facility Instrumentation and Controls (3)

CMET 6160 - Research and Analytical Methods (3)
CMET 6165 - Transportation Asset Management (3)
CMET 6180 - Alternative Project Delivery Methods (3)
CMET 6250 - Asset Management for Facility Managers (3)
CMET 6255 - Advanced Plant Layout and Design (3)
CMET 6275 - Advanced Construction Means and Methods (3)
CMET 6285 - Quality Assurance in Construction (3)
CMET 6295 - Design and Improvement of Construction Operations (3)
CMET 6800 - Independent Study in Construction and Facility Management (3)
ENER 5250 - Analysis of Renewable Energy Systems (3)
ENER 5275 - Air Conditioning Systems (3)
ENER 5285 - Applied Noise and Vibration Control (3)
ENER 5290 - Advanced Instrumentation (3)
ENER 6120 - Energy Generation and Conversion (3)
ENER 6135 - Energy Transmission and Distribution (3)
ENER 6150 - System Dynamics (3)
ENER 6170 - Applied Mechatronics (3)
ENER 6220 - High Voltage Technology (3)
ETGR 5272 - Engineering Analysis IV (3)

Coursework Sequence (21 credit hours)
Elective Courses (21 credit hours)
Select from the following or others with director approval:
CMET 5126 - Project Scheduling and Control (3)
CMET 5135 - Building Information Modeling (3)
CMET 5140 - Building Energy Management (3)
CMET 5150 - Green Building (3)
CMET 5160 - Advanced Construction Materials (3)
CMET 5290 - Temporary Structures in Construction (3)
CMET 5350 - Construction Geotechnics and Foundations (3)
CMET 6000 - Special Topics in Construction and Facility Management (3)
CMET 6145 - Facilities Management Financial Analysis (3)
CMET 6155 - Facility Instrumentation and Controls (3)
CMET 6160 - Research and Analytical Methods (3)
CMET 6165 - Transportation Asset Management (3)
CMET 6180 - Alternative Project Delivery Methods (3)
CMET 6250 - Asset Management for Facility Managers (3)
CMET 6255 - Advanced Plant Layout and Design (3)
CMET 6275 - Advanced Construction Means and Methods (3)
CMET 6285 - Quality Assurance in Construction (3)
CMET 6295 - Design and Improvement of Construction Operations (3)
CMET 6800 - Independent Study in Construction and Facility Management (3)
ENER 5250 - Analysis of Renewable Energy Systems (3)
ENER 5275 - Air Conditioning Systems (3)
ENER 5285 - Applied Noise and Vibration Control (3)
ENER 5290 - Advanced Instrumentation (3)
ENER 6120 - Energy Generation and Conversion (3)
ENER 6135 - Energy Transmission and Distribution (3)
ENER 6150 - System Dynamics (3)
ENER 6170 - Applied Mechatronics (3)
ENER 6220 - High Voltage Technology (3)
ETGR 5272 - Engineering Analysis IV (3)

Note: Additional new major electives courses may be created based on industry needs and faculty research interest. In addition, appropriate existing graduate level courses from other programs may be approved by the Graduate Program Director.

Capstone Experiences

Students pursuing the M.S. in Construction and Facilities Engineering have two options to complete the 30 credit hour program:

1) 24 credit hours of coursework plus 6 credit hours of thesis project
2) 30 credit hours of coursework and a comprehensive examination

Both options require the formation of a program committee. The thesis option is reserved for students who are attending the on-campus program and are performing research under formal graduate research or teaching assistantships. Students receiving such assistantships may be required to pursue the thesis option. The thesis option requires students to submit a written thesis and orally defend their work before their program committee.

All non-thesis students must complete 30 credit hours of coursework and successfully complete a formal comprehensive examination. The comprehensive examination is a written exam. A student's exam will be scheduled when they have at least 24 hours of course credit completed or in progress. The student's graduate advisor and the examining committee will coordinate the examination (to be offered once in the Fall and once in the Spring semesters), preparing the exam with the assistance of members of the student's program committee. The exam will measure the student's mastery of theories and applications in the selected area of specialization within the discipline. Students will have only two opportunities to receive passing marks on the examination.

Other Requirements

The program has both a thesis and non-thesis track. After admission to candidacy, thesis students will complete a comprehensive oral exam while non-thesis students will complete a comprehensive written exam. Residence will be per Graduate School rules. There is no language requirement. While full-time students will typically take three semesters to complete the program, part-time students are expected to take no more than seven years to complete the program, as per Graduate School rules.

Degree Total = 30 Credit Hours

Grade Requirements
All candidates must earn an overall 3.0 GPA to graduate. Accumulation of one U grade or three C grades will result in the suspension of the student's enrollment in the program.

Advising
Each student is supervised by their graduate advisor and a program committee.

Application for Degree
Each student should submit an Application for Degree prior to graduation. If a student does not graduate in the semester identified on the Application, the student must complete a new form and repay the application fee to be considered for graduation in a subsequent semester.

Program Committee
The Program Committee shall consist of at least three graduate faculty members. A graduate faculty from outside the Department of Engineering Technology and Construction Management or from outside the student's major area-of-study may serve as a member of the Program Committee. The student's CMET graduate advisor shall chair the committee.

Transfer Credit
The department, at its discretion, may accept transfer of graduate courses (6 credit hours maximum) taken at another institution or from another program prior to admission to the M.S. in Construction and Facilities Engineering program. Only courses in which the student earned a grade of B or above may be transferred.

Assistantships
Research and teaching assistantships are available from the department on a competitive basis to highly qualified applicants/students.

Tuition Grants
Tuition grants, including out-of-state tuition differential waivers and in-state tuition support, are available on a competitive basis for both out-of-state and in-state students, respectively.

ELECTRICAL AND COMPUTER ENGINEERING

- Ph.D. in Electrical Engineering
- M.S. in Computer Engineering (MSCPE)
- M.S. in Electrical Engineering (MSEE)
  - Power and Energy Systems

Department of Electrical and Computer Engineering
ece.charlotte.edu

Ph.D. in Electrical Engineering

The Ph.D. program is designed to provide the students with research-level expertise in a focus area within electrical and computer engineering and breadth of knowledge in areas related to the focus area. In addition to taking a set of courses in a chosen area of concentration, a key aspect of the doctoral degree is the student's research dissertation. Each dissertation is expected to be a significant original contribution on research on a chosen subject, leading to one or more archival publications. Successful doctoral candidates learn how to acquire advanced knowledge from published research articles, identify research problems, formulate plausible approaches to solve them, analyze and evaluate proposed solutions, and present technical material orally and in writing.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the Department of Electrical and Computer Engineering seeks the following from applicants to the Ph.D. in Electrical Engineering program:

1) A master's degree in electrical and/or computer engineering or a closely allied field, demonstrating strong academic background for performing research in a chosen area of interest *(Exceptional students with only a baccalaureate degree who are motivated to pursue a Ph.D. may also be considered for direct admission to the Ph.D. program)*
2) Satisfactory scores on the quantitative and verbal sections of the Graduate Record Examinations (GRE) general test*

3) A statement of purpose, written by the applicant, that specifies the applicant's research interests within Electrical and Computer Engineering

**The GRE requirement will be waived for:*

- *Applicants who have an undergraduate degree from an ABET-accredited U.S. institution and have at least three years post-graduation experience in the related field*
- *Recent UNC Charlotte undergraduates with a minimum GPA of 3.25*
- *Currently enrolled UNC Charlotte undergraduate students eligible for the MSEE Early Entry Program with a minimum GPA of 3.25*

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The following is a chronologically ordered set of requirements for the Ph.D. degree in Electrical Engineering:

1) Appointment of a Ph.D. advisor and formation of an advisory committee
2) Development of a Ph.D. Plan of Study detailing all course and examination requirements
3) Successful completion of the qualifying examinations
4) Presentation of a proposal for Ph.D. research and admission to candidacy
5) Successful defense of the Ph.D. Dissertation

Within the first semester of being admitted into a Ph.D. program, the student should choose a Ph.D. advisor and form an advisory committee. In conjunction with the Ph.D. advisor and this advisory committee, the student will develop a Plan of Study to meet the Ph.D. program requirements of coursework and examinations and prepare to undertake original research leading to a doctoral dissertation. Normally, a student would be expected to have at least one archival publication on the research performed for the dissertation.

Plan of Study

The Plan of Study must be submitted to the Director of Graduate Programs for review and approval within the second semester of enrollment in the Ph.D. program. The Plan of Study must show a minimum of 72 credit hours beyond the baccalaureate degree, including 18 credit hours of doctoral dissertation and 54 credit hours of coursework. Additional doctoral dissertation credit hours may be applied as coursework with the approval of the Graduate Program Director.

The specific course requirements will be set by the student's Advisory Committee. Doctoral students should take 8000-level courses when they are available. 6000- and 5000-level graduate courses that do not have 8000-level counterparts may also be counted towards the doctoral degree if approved by the Advisory Committee. For students who do not possess bachelor's and/or master's degrees in appropriate fields of study, additional coursework may be required. Courses taken without the approval of the advisory committee may not be counted toward the degree.

Degree Total = 72 Credit Hours

Grade Requirements

A student must have a GPA of at least a 3.0 in order to graduate. The dissertation is graded on a Pass/Unsatisfactory basis and, therefore, will not be included in the cumulative GPA. An accumulation of more than two marginal (C) grades will result in suspension of the student's enrollment in the graduate program. If a student makes a grade of U on any course, enrollment will be suspended. A graduate student whose enrollment has been suspended because of grades is ineligible to attend any semester or summer session unless properly readmitted to the graduate program. Readmission to the program requires approval of the Dean of the Graduate School upon the recommendation of the student's major department.

Residence

A student may satisfy the residency requirement for the program by completing 18 hours, either coursework or research credits, by study-in-residence during the academic year and during the summer terms, as long as the study is continuous. Study-in-residence is deemed to be continuous if the student is enrolled in one or more courses (including research/dissertation credit) in successive semesters until eighteen hours of credit are earned.

Qualifying Examination

In addition to demonstrating a high level of competence in coursework, the student must pass the Ph.D. qualifying examinations. The qualifying examination should be taken before completion of 24 hours beyond the master's degree but must be passed no later than four semesters after initial enrollment in the program. Failure to pass the qualifying examination after two attempts will result in the termination of the student's enrollment in the Ph.D. program.

The qualifying examination is divided into two test sessions. The first session comprises of a written examination on the breadth areas of electrical and computer engineering, and the second session is a research aptitude test that comprises of a technical presentation. . For a detailed description of the procedures for the Ph.D. qualifying examinations in electrical and computer engineering please contact the ECE department or visit ece.charlotte.edu.

Dissertation Proposal and Admission to Candidacy

Because the Ph.D. program is heavily based on independent research, each student must write a proposal describing their proposed dissertation research following the technical guidelines established by the department. The proposal must be presented to and orally defended before the student's advisory committee. The proposal must be presented within one year after the qualifying examination is passed. Upon approval of the student's dissertation proposal, the advisory committee will recommend the student's admission to candidacy subject to the approval of the Engineering Doctoral Graduate Committee and the Dean of the Graduate School.

Dissertation

Evidence of a high degree of competence in scholarship, written exposition, independent inquiry and the ability to organize and apply knowledge must be demonstrated by the student in the dissertation. The student will make a public defense of the dissertation at which time the dissertation, as well as the student's knowledge of the field, will be appropriate matter for examination by the student's advisory committee. Although questions may be asked by the general audience, evaluation of the dissertation defense is the sole responsibility of the advisory committee. The dissertation will be graded on a Pass/Unsatisfactory basis.

Application for Degree

Students preparing to graduate must submit an online Application for Degree by the filing date specified in the University Academic Calendar. If a student does not graduate in the semester identified on the Application for Degree, then the student must update their Admission to Candidacy and submit a new Application for Degree for graduation in a subsequent semester.

Time Limit

Students are allowed a maximum of nine calendar years from formal admission to the Ph.D. program to complete the program successfully.

Assistantships

There are two forms of assistantships that are offered by the ECE Department. These are Teaching Assistantships (TAs) and Research Assistantships (RAs). RAs are controlled by faculty members with research grants, and the faculty members make the decisions in selecting students for RAs. Therefore, for RAs, students should contact individual faculty members directly. TAs are given to students to help faculty members with classroom teaching or laboratory instruction and these allocations are related to the ECE department needs and available resources. In all cases, the TAs and RAs are awarded to exceptional students. Application forms are available online at ece.charlotte.edu.

Tuition Waivers

For exceptionally qualified candidates who are awarded TAs or RAs, a limited number of tuition awards are available on a competitive basis.

Advanced Standing Option

Students who hold a master's degree in electrical engineering, computer engineering, or a closely related field, may opt for the Advanced Standing Option for the Ph. D. in Electrical Engineering program.

Admission Requirements

In order to be admitted into the Advanced Standing Option for the Ph.D. in Electrical Engineering program, students must meet all the admission requirements of the Ph.D. program above AND must have earned a master's degree in electrical engineering, computer engineering, or closely related fields. All other students should apply to the Ph.D. program above (without the Advanced Standing Option). Eligibility for this accelerated option is subject to review by the Graduate School.

Degree Requirements

The degree requirements for the Advanced Standing Option are similar to the requirements for the Ph.D. in Electrical Engineering program above except that the total required number of credit hours is reduced to 42.

The required minimum of 42 credit hours under the Advanced Standing Option should include 18 credit hours of doctoral dissertation credits and 24 credit hours of coursework. Additional doctoral dissertation credits may be applied as coursework with the approval of the Graduate Program Director.

No transfer credits are allowed under this accelerated option.

Degree Total = 42 Credit Hours

M.S. in Computer Engineering (MSCPE)

The M.S. in Computer Engineering (MSCPE) program is designed to impart advanced knowledge on current and future generation computer hardware and software technologies. The program is structured to emphasize the broad areas of Computer Architecture and Hardware Design; Computer Systems and Applications Software; and Distributed and Real-time Computer Systems. In addition to taking graduate-level courses in one or more areas of concentration within the department, students in the MSCPE program have the opportunity to engage in research and individualized projects.

Active research areas in computer engineering include: embedded systems, robotics, computer architecture, hardware/software co-design, real-time systems, reconfigurable and high performance computing, VLSI design, Big Data, mobile and edge computing, computer networks, Internet of Things, cyber-physical systems, digital signal and image processing, deep learning and machine learning algorithms, computer vision, hardware security, low-power electronics, operation and control of the Smart Grid, and others. A full range of state-of-the-art laboratories is available, enabling faculty and students to conduct research at the cutting edge of technology.

Admission Requirements

In addition to the established Graduate School admissions criteria, the Department of Electrical and Computer Engineering seeks the following from applicants to the Master's program in Computer Engineering (MSCPE):

- An earned undergraduate degree in Electrical and Computer Engineering or a closely related field of engineering or sciences
  - Applicants with baccalaureate degrees in fields other than Electrical and Computer Engineering (e.g. physics, mathematics, computer science, etc.) may be considered for admission, if satisfactory evidence on the aptitude to pursue graduate studies in Electrical and Computer Engineering is demonstrated. If additional preparatory courses are required, such courses should be taken before applying for the MSCPE.
- A proven track record with a minimum undergraduate GPA of 3.0 on a 4.0 scale
- Additional academic credentials, such as other attempted post-baccalaureate studies undertaken, if applicable, may also be submitted
- Satisfactory scores in the quantitative and verbal sections of the Graduate Record Examinations (GRE) general test
- For international applicants from non-English speaking countries, a minimum Test of English as a Foreign Language (TOEFL) score of 220 (computer-based), 557 (paper-based), or 83 (internet-based) must be obtained. Other official English proficiency tests such as MELAB and IELTS may also be acceptable, as stated in the Graduate School's admissions section.
- Admission is based on the overall background, motivation, and potential, as determined by the department

GRE Waiver

The GRE requirement will be waived for:

- Applicants who have an undergraduate degree from an ABET-accredited U.S. institution and have at least three years post-graduation experience in the related field
- Recent UNC Charlotte undergraduate graduates with a minimum GPA of 3.25

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The MSCPE program requires successful completion of 30 graduate credit hours as approved by the student's graduate advisor. At least 24 credit hours applied to the MSCPE degree must be from the Department of Electrical and Computer Engineering. This can be done using one of three options:

1) **Thesis option** - 9 credit hours of thesis and 21 credit hours of coursework
2) **Project option** - 3 credit hours of individual study and projects and 27 credit hours of coursework
3) **Comprehensive Examination option** - 30 credit hours of coursework and a comprehensive written examination

Core Courses (9 credit hours)

All options require students to complete the following:
ECGR 5101 - Advanced Embedded Systems (3)
ECGR 5181 - Computer Architecture (3)
ECGR 5187 - Data Communications and Networking II (3)

Elective Courses

Select from the following elective courses to complete the degree requirements. Courses not included in this list, including new and special topics courses on computer engineering, may be eligible with approval from the

student's graduate advisor. Also, online courses offered through the NCSU Engineering Online program would be eligible. (Note: A maximum of 6 credit hours of transfer credit, including courses taken through NCSU Engineering Online, are permitted.)

ECGR 5090 - Special Topics (1 to 6)
ECGR 5100 - Research Tools and Techniques in Computer Engineering (3)
ECGR 5103 - Applied Computer Graphics (3)
ECGR 5124 - Digital Signal Processing (3)
ECGR 5133 - VLSI Systems Design (3)
ECGR 5134 - Advanced VLSI Systems Design (3)
ECGR 5146 - Introduction to VHDL (3)
ECGR 5196 - Introduction To Robotics (3)
ECGR 6090 - Special Topics (1 to 6)
ECGR 6101 - Advanced Computer Graphics (3)
ECGR 6114 - Digital Signal Processing II (3)
ECGR 6118 - Applied Digital Image Processing (3)
ECGR 6119 - Applied Artificial Intelligence (3)
ECGR 6120 - Wireless Communication and Networking (3)
ECGR 6146 - Advanced VHDL (3)
ECGR 6181 - Embedded Operating Systems (3)
ECGR 6182 - Advanced Embedded Operating Systems (3)
ECGR 6185 - Embedded Commercial Product Design (3)
ECGR 6188 - Fundamentals of Wireless Systems and Protocols (3)
ECGR 6189 - Wireless Sensor Networks (3)
ITCS 6114 - Algorithms and Data Structures (3)
ITCS 6151 - Intelligent Robotics (3)
ITCS 6152 - Robot Motion Planning (3)

MSCPE Options

All students enrolled in MSCPE must meet the Graduate School's general requirements for a master's degree at UNC Charlotte. Students must meet with their advisor to formulate a plan of study and get the committee's approval. The plan of study must be submitted after completing at least 9 but no more than 18 credit hours. In addition, students should note the following requirements based on their selected option:

Thesis Option

Students opting for the thesis option must take 9 credit hours of ECGR 6991 and 21 credit hours of coursework. A committee of three graduate faculty members must approve the final written thesis and oral defense.

ECGR 6991 - Graduate Master Thesis Research (6)

Non-Thesis Project Option

Students opting for the non-thesis project option must take 3 credit hours of ECGR 6890 and 27 credit hours of coursework. A committee of three graduate faculty members must approve the final oral defense and a written project report.

ECGR 6890 - Individualized Study and Projects (1 to 6)

Non-Thesis Comprehensive Examination Option

Students who elect the non-thesis comprehensive examination option must complete 30 credit hours of approved coursework and pass the written comprehensive examination that is administered by the department. Students have two chances to successfully pass the comprehensive examination.

Degree Total = 30 Credit Hours

Grade Requirements

A graduate student must have a minimum grade point average (GPA) of 3.0 on the plan of study. Courses graded as C must be offset by an equal number of graduate level credits graded as A.

M.S. in Electrical Engineering (MSEE)

The M.S. in Electrical Engineering (MSEE) program provides students with advanced knowledge on the theory and applications of electrical systems and signal processing. The program spans across the broad areas of communications, controls, and signal processing; electronic and electromagnetic devices; and power and energy systems. Sub-specialties include metamaterials, antennas, photonics, wireless communications and networking, robotics and dynamical systems, image processing and computer vision, machine learning, power generation and delivery, renewable energy, and power electronics.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the Department of Electrical and Computer Engineering seeks the following from applicants to the Master's programs in Electrical Engineering:

Applicants should have baccalaureate degrees in electrical and/or computer engineering with a GPA of at least 3.0 out of 4.0. Applicants with baccalaureate degrees in fields closely related to electrical and computer engineering (e.g., electronics, computer science, mathematics, physics, etc.) may also be considered. However, satisfactory evidence on the aptitude to pursue graduate studies in electrical and computer engineering must be demonstrated. If additional preparatory courses are required, such courses should be taken before applying for the MSEE.

Applicants must have also satisfactory scores in the quantitative and verbal sections of the Graduate Record Examinations (GRE) general test. The GRE requirement will be waived for:

- Applicants who have an undergraduate degree from an ABET-accredited U.S. institution and have at least three years post-graduation experience in the related field
- Recent UNC Charlotte undergraduates with a minimum GPA of 3.25
- Currently enrolled UNC Charlotte undergraduate students eligible for the MSEE Early Entry Program with a minimum GPA of 3.25

Admission is based on the overall background, motivation, and potential, as determined by the department.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The MSEE degree requires successful completion of 30 graduate credit hours as approved by the student's graduate advisor. This can be done with one of three options:

1) Thesis option - the student completes 9 credit hours of thesis (ECGR 6991) and 21 credit hours of coursework
2) Project option - the student completes 3 credit hours of individual study and projects (ECGR 6890) and 27 credit hours of coursework
3) Comprehensive Examinations option - the student completes 30 credit hours of coursework and pass a comprehensive written examination

The 30 credit hours must be completed in accordance with the following criteria: a) Technical Area of Focus (at least 9 credit hours) and b) Breadth of Knowledge (at least 6 credit hours). The remaining credit hours can be completed using thesis, project, and/or coursework.

All students must also meet the Advanced Knowledge criteria that requires at least 12 credit hours to be at the 6000-level or above, with at least 3 credit hours at the 6000-level or above in the chosen Technical Area of Focus. No more than 6 credit hours may be in Individual Study. No more than 6 credit hours may be from courses outside the Department of Electrical and Computer Engineering, unless approved by the student's graduate advisor.

Technical Area of Focus (9 credit hours)

Select three courses from a single technical area of focus. Special topic courses (ECGR 6090 or ECGR 8090) may also be counted towards this requirement, as approved by the student's graduate advisor.

Communications and Networking

ECGR 5187 - Data Communications and Networking II (3)
ECGR 5191 - Analog and Digital Communication (3)
ECGR 6120 - Wireless Communication and Networking (3)
ECGR 6121 - Advanced Theory of Communications I (3)
ECGR 6187 - Modeling and Analysis of Communication Networks (3)
ECGR 6188 - Fundamentals of Wireless Systems and Protocols (3)
ECGR 6189 - Wireless Sensor Networks (3)

Signal and Image Processing

ECGR 5103 - Applied Computer Graphics (3)
ECGR 5122 - Random Processes and Optimum Filtering (3)
ECGR 5124 - Digital Signal Processing (3)
ECGR 5190 - Acoustics (3)
ECGR 6114 - Digital Signal Processing II (3)
ECGR 6118 - Applied Digital Image Processing (3)
ECGR 6119 - Applied Artificial Intelligence (3)
ECGR 6127 - Medical Signal Processing (3)

Controls and Robotics

ECGR 5111 - Control Systems (3)
ECGR 5112 - Nonlinear Analysis (3)
ECGR 5124 - Digital Signal Processing (3)
ECGR 5161 - Control of Robotic Manipulators (3)
ECGR 5196 - Introduction To Robotics (3)
ECGR 5412 - Principles of Digital Control Systems (3)
ECGR 6111 - Linear Systems Theory (3)
ECGR 6115 - Optimal Control Theory (3)

Electromagnetics, Antennas, and RF

ECGR 5121 - Antennas (3)
ECGR 5123 - Advanced Electromagnetic Field Theory (3)
ECGR 5261 - Microwave Circuit Design I (3)
ECGR 6264 - Radio Frequency Design (3)

Electronic Devices and Systems

ECGR 5125 - Foundation of Optical Engineering (3)
ECGR 5132 - Analog Integrated Circuit Design (3)
ECGR 5136 - Semiconductor Optoelectronic Materials and Devices (3)
ECGR 5431 - Linear Integrated Electronics (3)
ECGR 6132 - Advanced Semiconductor Device Physics (3)

Power Systems

ECGR 5104 - Computational Methods in Power Systems (3)
ECGR 5142 - Power Generation: Operation and Control (3)
ECGR 5171 - Introduction to Energy Systems (3)
ECGR 5172 - Energy Markets (3)

ECGR 5193 - Power System Analysis I (3)
ECGR 5194 - Power System Analysis II (3)
ECGR 6144 - Electric Power Distribution Systems I (3)
ECGR 6145 - Electric Power Distribution Systems II (3)
ECGR 6147 - Power System Stability and Control (3)
ECGR 6173 - Power Quality (3)
ECGR 6190 - Smart Grid: Characteristics, Design, and Analysis (3)

Power Electronics and Machines
ECGR 5144 - Power Electronics I (3)
ECGR 5195 - Electrical Machinery (3)
ECGR 6197 - Power Electronics II (3)
ECGR 6199 - Dynamics and Control of AC Drives (3)

Breadth of Knowledge Requirement (6 credit hours)
Select courses from at least two technical areas listed above other than the chosen technical area of focus. Courses in the M.S. in Computer Engineering can also be taken to fulfill the breadth of knowledge requirement.

Advanced Knowledge Requirement (12 credit hours)
At least 12 credit hours must be taken at the 6000-level or above. At least 3 credit hours at the 6000-level or above should be in the student's chosen Technical Area of Focus.

Thesis, Project, and Comprehensive Examination Options
Select one of the following options to complete the degree requirements:

Thesis Option
In the Thesis Option, students must complete 9 credit hours of thesis research.

1) Plan of Study - students must meet with their advisor to formulate a plan of study and get the committee's approval. The plan of study must be submitted after completing at least 9 but no more than 18 credit hours.
2) Satisfactory completion of 30 credit hours of approved graduate credits in major or related area of study including 9 credit hours of thesis.
3) Admission to Candidacy
4) Thesis Defense - a copy of the thesis should be distributed to each member of the program committee at least two weeks prior to the defense. Students should make a public announcement of the defense within the department to allow attendance by interested faculty members and students of electrical and computer engineering.

For the thesis option, students must select a program committee that is composed of at least 3 members of the graduate faculty, the majority of whom must be members of the Department of Electrical and Computer Engineering. The graduate program advisor generally serves as the chairman of the committee.

Non-Thesis/Project Option
In this option, students may complete the requirements of the Master's degree under the Non-Thesis/Project Option by taking 30 credit hours of coursework only, or by taking 27 credit hours of coursework along with 3 credits of individualized project work.

1) Plan of Study - students must meet with their advisor to formulate a plan of study and get the committee's approval. The plan of study must be submitted after completing at least 9 but no more than 18 credit hours.
2) Satisfactory completion of 30 credit hours of approved graduate credits. At least 24 credit hours of courses must be in the ECE department.
3) A student must take three credits of individualized project (ECGR 6890) that will require a written report and an oral presentation.
4) Admission to Candidacy
5) Students must pass an oral exam during the presentation of the project that is administered by the program advisory committee.

For the non-thesis/project option, the student's advisor alone plays the roles of the program committee (i.e., no other members are required).

Comprehensive Examination Option
1) Plan of Study - students must meet with their advisor to formulate a plan of study and get the committee's approval. The plan of study must be submitted after completing at least 9 but no more than 18 credit hours.
2) Satisfactory completion of 30 credit hours of approved graduate coursework. At least 21 credit hours of courses must be in the ECE department.
3) Admission to Candidacy
4) Students must pass a written comprehensive examination that is administered by the department. Students receive two chances to successfully pass the comprehensive examinations.

Optional Concentration in Power and Energy Systems
The Department of Electrical and Computer Engineering offers an optional Concentration in Power and Energy Systems for the MSEE degree, which requires taking a set of core and elective courses from the Power Systems, the Power Electronics and Machines, and the Controls and Robotics technical areas of focus. Students who elect to pursue the Concentration in Power and Energy Systems towards their MSEE degree primarily take coursework in modern power and energy systems, devices modeling, analysis, protection and control. This concentration prepares students for jobs with power utilities, power and energy devices manufacturing companies, national and regional laboratories, or for continued academic training in power and energy fields. The concentration is reflected in

the student's transcript upon successful completion of the MSEE program. Students interested in earning their MSEE degree with the concentration must indicate their interest in this option in their Plan of Study that must be submitted within their second semester into the MSEE program. The MSEE degree can also be earned without specifying a concentration, where the student has greater flexibility in selecting their courses.

In order to earn a MSEE degree with a Concentration in Power and Energy Systems, students must take:

- **Technical Area of Focus** - four core courses from one of the following technical areas of focus: (a) Power Systems, or (b) Power Electronics and Machines.
- **Breadth of Knowledge** - a minimum of three elective courses from the following technical areas of focus: (a) Power Systems, (b) Power Electronics and Machines, and (c) Controls and Robotics. Two of these elective courses must be from each of the two technical areas other than the primary. The third can be from any of the three technical areas of focus.
- The remaining credit hours can be thesis, project, and/or additional coursework.

Power Systems Technical Area of Focus Core Courses
ECGR 5142 - Power Generation Operation and Control (3)
ECGR 5104 - Computational Methods in Power Systems (3)
ECGR 5194 - Power System Analysis II (3)
ECGR 6144 - Electric Power Distribution Systems-I (3)

Note: Students who opt to take the Power Systems Technical Area of Focus of the Concentration in Power and Energy Systems are expected to have taken the following courses or their equivalents before entering the Master's program: ECGR 4141, ECGR 4143, and ECGR 4144. If a student has not taken these courses or their equivalents, the student must take their graduate equivalents as elective courses for the graduate concentration or obtain permission from their advisor.

Power Electronics and Machines Technical Area of Focus Core Courses
ECGR 5144 - Power Electronics (3)
ECGR 5195 - Electric Machinery (3)
ECGR 6197 - Power Electronics II (3)
ECGR 6199 - Dynamics and Control of AC Drives (3)

Note: Students who opt to take the Power Electronics and Machines Technical Area of Focus of the Concentration in Power and Energy Systems are required to have taken ECGR 4141 or its equivalent before entering the Master's program. If a student has not taken this course or its equivalent, the student must take its graduate equivalent as an elective course for the graduate concentration or obtain permission from their advisor.

Degree Total = 30 Credit Hours

Application for Degree

Students preparing to graduate must submit an online Application for Degree by the filing date specified in the University Academic Calendar. If a student does not graduate in the semester identified on the Application for Degree, then the student must update their Admission to Candidacy and submit a new Application for Degree for graduation in a subsequent semester.

ENERGY AND ELECTROMECHANICAL SYSTEMS

- M.S. in Applied Energy and Electromechanical Systems
- Graduate Certificate in Applied Energy

Department of Engineering Technology and Construction Management
et.charlotte.edu

M.S. in Applied Energy and Electromechanical Systems

The M.S. in Applied Energy and Electromechanical Systems engineering degree provides an opportunity for discipline-specific and multidisciplinary graduate level education. Advanced coursework and research are used to enhance professional development, improve technical competency, and initiate a lifelong learning experience. Full-time students typically take three semesters to complete the program.

Admission Requirements
The minimum admission requirements for the program are:
- An earned undergraduate degree in engineering, engineering technology, energy, or a closely related field
- An undergraduate GPA of 3.0 or above
- Acceptable scores on the verbal, quantitative, and analytical sections of the GRE
    - The GRE requirement will be waived for the following applicants:
        - UNC Charlotte students currently enrolled in The William States Lee College of Engineering
        - Applicants having earned a bachelor's degree in engineering, engineering technology, energy, or a closely related field from an ABET-accredited program
        - Applicants having earned a graduate degree
- Positive recommendations
- An acceptable TOEFL score is required if the previous degree was from a country where English is not the common language
- Integral and differential calculus (MATH 1121 or MATH 1241 or ETGR 2171, and ETGR 2272 or MATH 1242 at UNC Charlotte or equivalent from other institutions)
- Statistics (STAT 1220 or STAT 3128 at UNC Charlotte or equivalent from other institutions)
- Other credentials as required by the Graduate School
- Admission is based on the overall background, motivation, and potential, as determined by the program

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
The program leading to the Master of Science engineering degree in Applied Energy and Electromechanical Systems is a 30 credit hour program. Students select one of the three options described below; each contains requirements to complete core courses, elective courses, and a capstone experience.

Option A: Thesis
Requires the formation of a Master's Committee consisting of members of the Graduate Faculty, to be chaired by a member of the Department.
Requires successful completion of 24 credit hours of graduate-level coursework, research, and a thesis:
- 3 credit hours of Mathematics
- 6 credit hours of prescribed core courses
- 15 credit hours of electives
- 6 credit hours of research
- Successful oral defense of thesis work by the student's Master's Committee
- Acceptance of written thesis by the student's Master's Committee

Option B: Project (Non-thesis)
Requires successful completion of 27 credit hours of graduate-level coursework and a Capstone Project:
- 3 credit hours of Mathematics
- 6 credit hours of prescribed core courses
- 18 credit hours of electives
- 3 credit hours of individualized project work (as ENER-6850), concluding in a paper and successful presentation to graduate faculty members

Option C: Comprehensive Exam (Non-thesis)
Requires successful completion of 30 credit hours of graduate-level coursework and students must pass a written comprehensive that is administered by the

program:

- 3 credit hours of Mathematics
- 6 credit hours of prescribed core courses
- 21 credit hours of electives
- passing a written comprehensive that is administered by the program

Mathematics Course (3 credit hours)

Select one of the following:

ENER 5274 - Applied Computational Methods (3)
ETGR 5272 - Engineering Analysis IV (3)
MATH 5165 - Numerical Linear Algebra (3)
MATH 5172 - The Finite Element Method (3)
MATH 5173 - Ordinary Differential Equations (3)
MATH 5174 - Partial Differential Equations (3)
MATH 5176 - Numerical Methods for Partial Differential Equations (3)

Core Courses (6 credit hours)

ENER 6120 - Energy Generation and Conversion (3)
ENER 6150 - System Dynamics (3)

Elective Courses (Option A: 15 credit hours; Option B: 18 credit hours; Option C: 21 credit hours)

Students must take the prescribed number of elective credit hours (based on their chosen Option) from the following list. In addition, appropriate existing graduate-level courses from other programs may be approved by the Graduate Program Director, not to exceed 6 credit hours from outside of the department. Additional elective courses may be offered occasionally as Special Topics, based on industry needs and faculty research interests.

CMET 5135 - Building Information Modeling (3)
CMET 5140 - Building Energy Management (3)
CMET 6155 - Facility Instrumentation and Controls (3)
CMET 6270 - Operation of Constructed Facilities (3)
ENER 5000 - Special Topics (1 to 4)
ENER 5123 - Active Filters (3)
ENER 5140 - Energy Management (3)
ENER 5152 - Digital Signal Processing (3)
ENER 5196 - Introduction to Robotics (3)
ENER 5250 - Analysis of Renewable Energy Systems (3)
ENER 5260 - Hydrogen Production and Storage (3)
ENER 5275 - Air Conditioning Systems (3)
ENER 5280 - Fuel Cell Technology (3)
ENER 5285 - Applied Noise and Vibration Control (3)
ENER 5290 - Advanced Instrumentation (3)
ENER 6000 - Special Topics in Applied Energy or Electromechanical Systems (1 to 3)
ENER 6135 - Energy Transmission and Distribution (3)
ENER 6170 - Applied Mechatronics (3)
ENER 6220 - High Voltage Technology (3)
ENER 6235 - Modern Electric Power Grids (3)
ENER 6260 - Computational Fluid Dynamics for Energy Applications (3)
ENER 6270 - Dynamic Systems Control and Design (3)
ENER 6800 - Independent Study (1 to 3)

Capstone Experiences

Thesis Research (Option A students) (6 credit hours)

For this capstone experience, students must take a total of 6 credit hours of Master's Research and Thesis; this is normally taken across two semesters of 3 credit hours each. During these 6 credit hours, students must conduct research on an approved topic, leading to the writing and defending of a thesis (in accordance with Graduate School policies).

ENER 6900 - Master's Research and Thesis (1 to 6)

Project Research (Option B students) (3 credit hours)

This capstone experience requires individual investigation in the form of a project in the areas of Applied Energy and/or Electromechanical Systems culminating in an exposition of results in the form of a formal presentation to faculty and a professional conference-formatted paper. The proposed project must be pre-approved by a mentoring member of the program graduate faculty and the Graduate Program Director.

ENER 6850 - Capstone Project (3)

Comprehensive Examination (Option C students)

The comprehensive examination is a written exam to be offered once in the fall and once in the spring semesters. A student's exam will be scheduled when they have at least 24 credit hours completed or in progress. The Program Director and the examining committee will coordinate the examination. The exam will measure the student's mastery of theories and applications in the discipline. Students will have only two opportunities to receive passing marks on the examination.

Degree Total = 30 Credit Hours

Grade Requirements

All candidates must earn an overall 3.0 GPA to graduate. Accumulation of one U grade will result in the suspension of the student's enrollment in the program.

Advising

Each student is advised by the Graduate Program Director and may be supervised by their graduate advisor and/or their program Master's Thesis Committee.

Application for Degree

Each student must apply for graduation by the published deadline in their final term. Students who apply to graduate but fail to finish will need to update their application to graduate to a future term.

Plan of Study Requirements
Each student is required to submit a Plan of Study to and receive approval from the program's Graduate Program Director before completing 9 graduate credit hours. The Plan may be reviewed and updated periodically with the approval of the Graduate Program Director.

Transfer Credit
The department, at its discretion, may accept transfer of graduate courses (6 credit hours maximum) taken at another institution or from another program prior to admission to the M.S. in Applied Energy and Electromechanical Systems program. Only courses in which the student earned a grade of B or above may be transferred.

Assistantships
Research and teaching assistantships are available from the Department on a competitive basis to highly qualified applicants/students.

Tuition Grants
Tuition grants including out-of-state tuition differential waivers and in-state tuition support are available on a competitive basis for both out-of-state and in-state students, respectively.

Graduate Certificate in Applied Energy

The Graduate Certificate in Applied Energy provides graduate students and professionals with the opportunity to reach a demonstrated level of competence in applied energy. Each course in this certificate is applicable toward either the M.S. in Applied Energy and Electromechanical Systems or the M.S. in Construction and Facilities Engineering degree requirements. The graduate certificate may act as a standalone graduate option for post-baccalaureate students, or may be pursued concurrently with the M.S. in Applied Energy and Electromechanical Systems or the M.S. in Construction and Facilities Engineering degree program at UNC Charlotte.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the Department of Engineering Technology and Construction Management seeks the following:

- Either a bachelor's degree in engineering, engineering technology, construction management or a closely related technical or scientific field.
- Undergraduate coursework of at least 3 semesters in engineering analysis or calculus
- An average GPA of 3.0 (out of 4.0)
- Applicants whose native language is not English, will need to satisfy the UNC Charlotte Graduate School's English proficiency requirements.

Early Entry Program
Undergraduate students with a GPA of 3.2 or above and with at least 75 credit hours completed toward a baccalaureate degree in Engineering or Engineering Technology at UNC Charlotte may be admitted as an Early Entry student provided they meet all other requirements of admission except the earned bachelor's degree.

Certificate Requirements
The certificate is awarded upon completion of four graduate level courses (12 credit hours) in the area of applied energy. The cumulative GPA must be at least 3.0 and at most one course with a grade of C may be allowed toward the certificate. Requests for other energy-related course substitutions may be approved at the discretion of the department graduate director.

Select four of the following:
CMET 5140 - Building Energy Management (3)
CMET 6155 - Facility Instrumentation and Controls (3)
ENER 5275 - Air Conditioning Systems - (3)
ENER 6120 - Energy Generation and Conversion (3)
ENER 6135 - Energy Transmission and Distribution (3)
ENER 6150 - System Dynamics (3)
ENER 6170 - Applied Mechatronics (3)
ETGR 5272 - Engineering Analysis IV (3)

Certificate Total = 12 Credit Hours

ENGINEERING MANAGEMENT

- M.S. in Engineering Management
  - Energy Analytics
  - Lean Logistics and Supply Chains
  - Systems Analytics

Department of Systems Engineering and Engineering Management
seem.charlotte.edu

M.S. in Engineering Management

The Master of Science in Engineering Management (MSEM) program prepares professionals for careers in managing projects, programs, systems, and organizations. Industrial, research, consulting, and commercial firms now demand engineering managers with both cutting-edge technical competence and the management skills necessary to forge linkages with the systems and business sides of these organizations. System analytics skills such as data visualization techniques, data warehousing and management for supporting system-wide decision-making, data-driven optimization methods for modeling, as well as simulation and quality control, are keys to developing novel solutions and to resolving organizational challenges with speed and accuracy. These managers must be able to form and manage high performance teams and manage business and technological operations. The program of study is necessarily multidisciplinary, combining elements of advanced study in various engineering disciplines with studies of business and system operations and organizational behavior.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the Engineering Management program seeks the following from applicants to the M.S. in Engineering Management program:

1) Either a bachelor's degree in engineering or a closely related technical or scientific field, or a bachelor's degree in business, provided relevant technical course requirements have been met
2) Undergraduate coursework in engineering economics, calculus, or statistics
3) An average GPA of 3.0 or above (on a 4.0 scale)
4) Satisfactory GRE or GMAT

Documents to be Submitted for Admission
1) Transcript(s) showing a baccalaureate degree in engineering, engineering technology, or a scientific discipline, or a baccalaureate degree in business administration from a college or university accredited by an accepted accrediting body
2) A satisfactory score on the General Test of the GRE or GMAT
3) Written descriptions of any relevant and significant work experience
4) Applicants whose native language is not English will need to satisfy the UNC Charlotte Graduate School's English proficiency requirements

GRE Waiver
Applicants with more than 2 years of relevant industry experience and a bachelor's degree in engineering from a U.S. ABET-EAC accredited program may have the GRE requirement waived. A waiver can be requested by submitting a transcript of the school and a statement detailing work experience.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
Students are responsible for verifying degree requirements listed in DegreeWorks and consulting with the Graduate Program Director regarding the study plan. Students select one of two options described below.

Option 1: Project
Complete 10 credit hours of core courses and 3 credit hours of Engineering Management Project (EMGT 6985). Completion of EMGT 6985 includes oral and written exams administered by the project advisor. In addition, the following elective/concentration courses must be completed:

- Elective/Concentration Courses for No Concentration - six elective courses (18 credit hours) from the approved list of electives.
- Elective/Concentration Courses for One Concentration - four courses (12 credit hours) for selected concentration and two elective courses (6 credit hours) from the approved list of electives.
- Elective/Concentration Courses for Two Concentrations* - eight courses (24 credit hours) for selected two concentrations. No elective courses are required.

** Option 1: Project with two concentrations requires successful completion of 37 credit hours.*

Option 2: Thesis

Complete 10 credit hours of core courses and 6 credit hours of Graduate Master Thesis Research (EMGT 6991). Successful completion of EMGT 6991 includes oral and written exams administered by the thesis committee in accordance with the guideline of the Graduate School. In addition, the following elective/concentration courses must be completed:

- Elective/Concentration Courses for No Concentration - five elective courses (15 credit hours) from the approved list of electives.
- Elective/Concentration Courses for One Concentration - four courses (12 credit hours) for selected concentration and one elective course (3 credit hours) from the approved list of electives.
- Elective/Concentration Courses for Two Concentrations** - eight courses (24 credit hours) for selected two concentrations. No elective courses are required.

*** Option 2: Thesis with two concentrations requires successful completion of 40 credit hours.*

Required Core Courses (10 credit hours)

Complete at least 6 credit hours of required core courses before enrolling in 6000-level courses.

EMGT 6980 - Industrial and Technology Management Seminars (1) *(Students should complete this course within the first or second semester of the program)*
EMGT 5201 - Fundamentals of Deterministic System Analysis (3)
EMGT 5202 - Fundamentals of Stochastic System Analysis (3)
EMGT 5203 - Fundamentals of Engineering Management (3)

Concentration Courses (12 credit hours)

Energy Analytics Concentration

While traditional power and energy education focuses on the engineering aspect of energy systems, today's energy industry is facing fierce competitions in the data science field. The Energy Analytics concentration of UNC Charlotte's MSEM program prepares the students for the data science career in the energy industry, so that the graduates can make informed decisions by extracting actionable insights from data.

Required Courses (12 credit hours)
Select four of the following. At least two of which must be EMGT 5961, EMGT 5962, and EMGT 5963.

EMGT 5961 - Introduction to Energy Systems (3)
EMGT 5962 - Energy Markets (3)
EMGT 5963 - Energy Systems Planning (3)
EMGT 5964 - Case Studies in the Energy Industry (3)
EMGT 6910 - Forecasting Techniques, Methodologies, and Practice (3)
EMGT 6965 - Energy Analytics (3)

Logistics and Supply Chains Concentration

The main objective of the Logistics and Supply Chains concentration is to build fundamental engineering management skills to effectively design, plan, and execute supply and logistics networks that deliver value to customers. This concentration helps students understand the principles of logistics and supply chain management, and provides them with the related decision-making and optimization methodologies, as well as analytical and continuous improvement tools and techniques to make the companies deliver goods and services successfully.

Required Courses (12 credit hours)
Select four of the following:
EMGT 5141 - Engineering Experimental Design (3)
EMGT 5170 - Total Quality Systems (3)
EMGT 6142 - Quality and Manufacturing Management (3)
EMGT 6901 - Advanced Project Management (3)
EMGT 6904 - Product and Process Design (3)
EMGT 6905 - Designed Experimentation (3)
EMGT 6920 - Logistics Engineering and Management (3)
EMGT 6924 - Lean Six Sigma Practice and Management (3)
EMGT 6926 - Lean Supply Networks (3)

Systems Analytics Concentration

Analytics helps the decision maker understand the system and make the best decision to improve the system. The Systems Analytics concentration offers balanced learning experiences on theoretical fundamentals as well as practical skills for a wide range of applications. Theoretical fundamentals train students to approach complex problems with rigorous logic and creativity. Practical skills equip students with computational problem-solving tools.

Required Courses (12 credit hours)
Select four of the following:
EMGT 5141 - Engineering Experimental Design (3)
EMGT 5142 - Reliability Management and Survival Analysis (3)
EMGT 6112 - Introduction to Dynamic Programming and Optimal Control (3)
EMGT 6116 - System Identification and Reinforcement Learning (3)
EMGT 6905 - Designed Experimentation (3)
EMGT 6906 - Processing Systems Simulation (3)
EMGT 6910 - Forecasting Techniques, Methodologies, and Practice (3)
EMGT 6912 - Computational Intelligence (3)
EMGT 6915 - Engineering Decision and Risk Analysis (3)
EMGT 6952 - Engineering Systems Optimization (3)
EMGT 6955 - Systems Reliability Engineering (3)
EMGT 6965 - Energy Analytics (3)

Approved Elective Courses

Depending on the degree and concentration options selected, remaining credit hours may be filled by taking elective courses. Any course from the Engineering Management Program, including the ones below, may be taken as an elective course.

EMGT 5090 - Special Topics (3)
EMGT 5114 - Production Control Systems (3)
EMGT 5141 - Engineering Experimental Design (3)
EMGT 5142 - Reliability Management and Survival Analysis (3)
EMGT 5150 - Leadership For Engineers (3)
EMGT 5154 - Bayesian Analysis for Human Decision (3)
EMGT 5170 - Total Quality Systems (3)
EMGT 5961 - Introduction to Energy Systems (3)
EMGT 5962 - Energy Markets (3)
EMGT 5963 - Energy Systems Planning (3)
EMGT 5964 - Case Studies in the Energy Industry (3)
EMGT 6090 - Special Topics (1 to 6)
EMGT 6112 - Introduction to Dynamic Programming and Optimal Control (3)
EMGT 6113 - Cluster Analysis and Applications (3)
EMGT 6116 - System Identification and Reinforcement Learning (3)
EMGT 6142 - Quality and Manufacturing Management (3)
EMGT 6901 - Advanced Project Management (3)
EMGT 6902 - Legal Issues in Engineering - Management (3)
EMGT 6904 - Product and Process Design (3)
EMGT 6905 - Designed Experimentation (3)
EMGT 6906 - Processing Systems Simulation (3)
EMGT 6910 - Forecasting Techniques, Methodologies, and Practice (3)
EMGT 6912 - Computational Intelligence (3)
EMGT 6915 - Engineering Decision and Risk Analysis (3)
EMGT 6920 - Logistics Engineering and Management (3)
EMGT 6924 - Lean Six Sigma Practice and Management (3)
EMGT 6926 - Lean Supply Networks (3)
EMGT 6930 - Capital Cost Estimating (3)
EMGT 6950 - Engineering Systems Integration (3)
EMGT 6952 - Engineering Systems Optimization (3)
EMGT 6955 - Systems Reliability Engineering (3)
EMGT 6965 - Energy Analytics (3)
EMGT 6985 - Engineering Management Project (3)
EMGT 6990 - Industrial Internship (1 to 3)

Two relevant graduate courses from other programs may be taken as elective courses for the engineering management degree with approval of the SEEM program. Courses completed from other departments as part of the M.S. concentrations count towards the two allowed electives. Students are responsible for fulfilling the prerequisites of the courses they plan to take from other graduate programs.

The following are recommended MBAD courses for electives:

MBAD 6141 - Operations Management (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6164 - Executive Communications (3)
MBAD 6165 - Negotiation and Conflict Management (3)

Note: Students are required to have adequate preparation prior to taking the required MBAD (Master of Business Administration) courses. Traditionally, this consists of at least completing courses in engineering economics, foundations of economics, and mathematics through differential and integral calculus. Students are advantaged by having completed courses in foundations of accounting and statistics.

Degree Total = 31 Credit Hours

Application for Degree

Students preparing to graduate must submit an online Application for Degree by the filing date specified in the University Academic Calendar. If a student does not graduate in the semester identified on the Application for Degree, then the student must update their Admission to Candidacy and submit a new Application for Degree for graduation in a subsequent semester.

FIRE PROTECTION AND SAFETY MANAGEMENT

- M.S. in Fire Protection and Safety Management

Department of Engineering Technology and Construction Management
et.charlotte.edu

M.S. in Fire Protection and Safety Management

The Master of Science in Fire Protection and Safety Management program provides an advanced technical background for safety professionals involved with fire protection / administration in areas such as fire protection analysis and design, fire service, and fire safety and security, as well as safety management, occupational safety, industrial hazards and safety, industrial hygiene, and related areas. The Fire Protection and Safety Management program is designed to provide the necessary knowledge and skills to begin work in many areas of the fire protection and occupational health and safety fields, and to solve safety problems in a complex technical society.

The program consists of a common core addressing basics of fire protection and safety management with the balance of coursework allowing students to specialize in fire protection, administration or safety management. Fire Protection coursework prepares fire protection professionals to use modern fire protection methodologies, techniques, and tools for fire protection design, fire investigation, industrial fire safety, key infrastructure security, safety assessment, and other fire safety related matters. Fire Administration coursework prepares those who are engaged in occupations in the fire, emergency services, and safety fields to effectively manage the administrative decision making requirements of both public and private entities. Safety Management coursework prepares professionals to evaluate industrial hazards, assess risk and develop safety management plans while addressing industrial hygiene, environmental pollution control, ergonomics, and human factors.

Admission Requirements
The minimum admission requirements for the program are:

1) An earned undergraduate degree in engineering, engineering technology, emergency management, occupational safety, industrial hygiene, safety management or a related technical or scientific discipline
2) A minimum undergraduate GPA of 3.0
3) Acceptable scores on the verbal, quantitative, and analytical sections of the GRE
4) Positive recommendations
5) A combined TOEFL score of 220 (computer-based) or 557 (paper-based) is required if the previous degree was from a country where English is not the common language
6) Statistics (STAT 1220 or STAT 3128 at UNC Charlotte or equivalent) preferred; students without a background in statistics may remediate during the first semester after admission to the program
7) Other credentials as required by the Graduate School

Documents to be Submitted for Admission
1) Official transcripts from all colleges and universities attended.
2) Official GRE scores.
3) Official TOEFL scores.
4) The UNC Charlotte application for graduate admission online.
5) An essay detailing the applicant's motivation and career goals, along with any specific research and training interests.
6) Three professional recommendations.
7) Others as required by the Graduate School.

GRE Waiver
The GRE requirement will be waived for the following applicants:

- UNC Charlotte students currently enrolled in engineering technology, construction management, or engineering
- Applicants having earned a bachelor's degree in engineering, engineering technology, fire safety engineering technology or a closely related field from an ABET-accredited program
- Applicants having earned a graduate degree

Application Deadline
Applications can be received by the Graduate Admission Office any time prior to their published deadlines. In order to be considered for assistantships and tuition grants for the following academic year, students should apply by March 1 for priority consideration. The first round of award decisions typically occur by March 15. However, the Department of Engineering Technology and Construction Management will evaluate admission applications at any time complete applications are received by the Graduate School.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work

toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The minimum requirement for the M.S. in Fire Protection and Safety Management degree is 30 credit hours beyond the baccalaureate degree. This includes a minimum of 24 credit hours of formal coursework. Students enrolled will: 1) take a common core of 15 credit hours which includes study in both fire protection and safety management.; and 2) select 15 credit hours of directed electives. Students who elect the thesis option must complete 6 credit hours of MFPA 6900 as part of the directed electives. Students who select the non-thesis option will complete 30 credit hours of coursework and complete a comprehensive exam. The 30 credit hour degree program is outlined below:

Common Core Courses (15 credit hours)

MFPA 5123 - Human Behavior in Fire (3)
MFPA 5132 - Fire and Building Codes, Standards and Practices (3)
MFPA 5144 Fire Protection Systems (3)
MFPA 5223 - Industrial Safety and Facilities Management (3)
ETGR 5302 - Industrial Hygiene (3)

Elective Courses (15 credit hours)

Select five of the following:
MFPA 5150 - Human Resource Management in Emergency Services (3)
MFPA 6113 - Fire Failure Analysis (3)
MFPA 6126 - Arson (3)
MFPA 6164 - Fire Science Laboratory (3)
MFPA 6232 - Structural Fire Safety (3)
MFPA 6233 - Performance-Based Design (3)
MFPA 6243 - Research Investigation (3)
MFPA 6244 - Fire Detection and Smoke Management (3)
MFPA 6252 - Law and Fire Safety (3)
MFPA 6255 - Leadership/Conflict Management in Public Emergency Services (3)
MFPA 6260 - Organization and Management of Public Fire Protection - (3)
MFPA 6270 - Budgeting, Grants, Contracts and Finance in Emergency Services - (3)
MFPA 6800 - Independent Study (1 to 3)
MFPA 6900 - Thesis (6)
CMET 5135 - Building Information Modeling (3)
CMET 5140 - Building Energy Management (3)
CMET 6240 - Safety and Risk Management (3)
CMET 6270 - Operation of Constructed Facilities (3)

Note: Additional new major elective courses may be created based on industry needs and faculty research interest. In addition, appropriate existing graduate level courses from other programs may be approved by the Graduate Program Director.

Capstone Experience

Students pursuing the M.S. in Fire Protection and Safety Management have two options to complete the 30 credit hour program as follows:

1) 24 credit hours of coursework plus 6 credit hours of thesis project (MFPA 6900)
2) 30 credit hours of coursework and a comprehensive examination

Both options require the formation of a program committee. The thesis option is reserved for students who are attending the on-campus program and are performing research under formal graduate research or teaching assistantships. Students receiving such assistantships may be required to pursue the thesis option. The thesis option requires students to submit a written thesis and orally defend their work before their program committee.

All non-thesis students must complete 30 credit hours of coursework and successfully complete a formal comprehensive examination. A student's exam is scheduled when they have at least 24 credit hours of course credit completed or in progress. The student's graduate advisor and the examining committee coordinates the examination (to be offered once in the Fall and once in the Spring semesters), preparing the exam with the assistance of members of the student's program committee. The exam measures the student's mastery of theories and applications in the selected area of specialization within the discipline. Students have only two opportunities to receive passing marks on the examination.

Other Requirements

The program has both a thesis and non-thesis track. After admission to candidacy, thesis students will complete a comprehensive oral exam while non-thesis students will complete a comprehensive written exam. Residence will be per Graduate School rules. There is no language requirement. While full-time students will typically take three semesters to complete the program, part-time students are expected to take no more than seven years to complete the program as per Graduate School rules.

Degree Total = 30 Credit Hours

Grade Requirements

All candidates must earn an overall 3.0 GPA to graduate. Accumulation of one U grade will result in the suspension of the student's enrollment in the program.

Advising
Each student is supervised by their graduate advisor and a program committee.

Application for Degree
Each student should submit an Application for Degree prior to graduation. If a student does not graduate in the semester identified on the Application, the student must complete a new form and repay the application fee to be considered for graduation in a subsequent semester.

Plan of Study Requirements
Each student is required to submit a Plan of Study to the Department's Graduate Director before completing 18 credit hours of graduate credits.

Transfer Credit
The department, at its discretion, may accept transfer of graduate courses (6 credit hours maximum) taken at another institution or from another program prior to admission to the M.S. in Fire Protection and Safety Management program. Only courses in which the student earned a grade of B or above may be transferred.

Assistantships
Research and teaching assistantships are available from the Department on a competitive basis to highly qualified applicants/students.

Tuition Grants
Tuition grants, including out-of-state tuition differential waivers and in-state tuition support, are available on a competitive basis for both out-of-state and in-state students, respectively.

INFRASTRUCTURE AND ENVIRONMENTAL SYSTEMS

- Ph.D. in Infrastructure and Environmental Systems

Graduate Program
ines.charlotte.edu

Ph.D. in Infrastructure and Environmental Systems

The Ph.D. in Infrastructure and Environmental Systems (INES) is an interdisciplinary program emphasizing: (a) innovations in design, analysis, construction and operation of urban, energy, and environmental infrastructures; (b) scientific analysis of environmental systems and contemporary sustainability issues; and (c) exploration of sustainable and renewable resources. The interplay between the environment and infrastructure is thoroughly studied by students as they confront the challenges facing urbanizing regions. INES engages a diverse group of talented faculty from the science, engineering and management disciplines. INES students are required to conduct interdisciplinary and original research that contributes new knowledge to the profession, as evidenced by scholarly publications in refereed journals. The program is intended to:

1) Provide students with educational opportunities in science, engineering, and management, culminating in an interdisciplinary research-based Ph.D. in Infrastructure and Environmental Systems
2) Involve students in emerging issues pertaining to infrastructure and the environment for promoting regional and national economic and social development, as well as policy implications
3) Prepare students for careers as research scientists, resources and systems managers, professional engineers and educators who are capable of advancing knowledge in sciences, technology, and management relevant to infrastructure and environmental systems

INES students can participate in multidisciplinary activities provided by the UNC Charlotte research centers such as the Infrastructure, Design, Environment, and Sustainability (IDEAS) Center; the Center for Applied Geographic Information Science (CAGIS); the Energy Production and Infrastructure Center (EPIC); the Center for Advanced Multimodal Mobility Solutions and Education; the Center

for Transportation Policy Studies; the NSF I/UCRC Sustainably Integrated Buildings and Sites; the Integrated Design Research Lab and the Urban Institute. Current areas of INES research can be categorized as follows:

- Architecture and landscape
- Building and infrastructure security
- Climate change and atmospheric dynamics
- Civil infrastructure and materials
- Earth and geo-environmental systems
- Ecological valuation and stream restorations
- Energy analytics
- Environmental science and technology
- Integrated building design and BIM
- Natural hazards and geophysics
- Quaternary geology and landform evolution
- Renewable energy and environmental economics
- Systems optimization and management
- Transportation systems analysis and operation
- Urban and regional planning
- Integrated watershed management

Program Learning Outcomes

Doctoral students engage in coursework that develops their competency for research. Students generate knowledge through research and become competent scientists and engineers. During this process, students acquire knowledge of foundation subjects and specialty areas within their focus of research and, as a result, they develop into professionals.

Specific outcomes of the INES program are that students completing the Ph.D. degree will demonstrate abilities to analyze and evaluate advanced topics in engineering and/or science, to communicate technical information effectively, to discover and create new knowledge, and to understand interactions among advanced topics in science, engineering, and management.

Admission Requirements

The following are general guidelines for successful admissions into the Ph.D. in Infrastructure and Environmental Systems program:

- The equivalent to a U.S. baccalaureate and a master's degree, from a college or university accredited by an accepted accrediting body, in architecture, construction, engineering, earth sciences, energy, environmental studies, geology, management, resources economics, transportation, or a related field with a minimum undergraduate GPA of 3.20 and a minimum graduate GPA of 3.50 (on a 4.00 scale) in all graduate work. Applicants meeting these requirements will be admitted to the Advanced Standing Track (see Degree Requirements for details).
- Applicants holding only baccalaureate degrees with an undergraduate GPA of 3.75 or above may be considered for admission into the regular track (see Degree Requirements for details).
- Applicants working toward a master's degree or holding a master's degree in an unrelated field with a minimum GPA of 3.50 will be admitted into the regular track (see Degree Requirements for details).
- An acceptable TOEFL or IELTS score as required by the Graduate School for international students.
- Three letters of reference, two of which must be from faculty members.
- An essay of less than 500 words to address the applicant's motivation and research issues of interest.
- Students entering the program are expected to remediate any coursework deficiencies identified by their advisory committee in the first semester after enrolling in the program. The required coursework depends on the background of the student and is established by the INES Program Director and the student's research advisor.

Documents Required for Application of Admission

The Office of the Graduate School at UNC Charlotte requires the following documents be submitted in the application package for each student:

1) One official transcript from all colleges and universities attended
2) Official TOEFL or IELTS scores if the student's native language is not English
3) UNC Charlotte graduate online application
4) Three letters of reference
5) An essay which addresses the applicant's motivation and research issues of interest
6) A current curriculum vitae

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Admission Assessment

- The INES Program Committee reviews applications and recommends to the Program Director whether each applicant should be admitted or not and, if so, under what conditions.
- For each entering student, a member of the INES faculty is selected to serve as the student's interim advisor for the first year of study.

Student Responsibility

Students entering the program must present evidence that they are capable of undertaking the coursework required of them. Such evidence must include familiarity, background, and/or interest in infrastructure and environmental issues.

Students may have completed equivalent courses elsewhere. Normally, transcripts provide the evidence required by the Program Committee. However, if the

student's previous experience is offered as evidence, the student must provide all the documentation necessary to specify such experience. Visit ines.charlotte.edu for other details.

Degree Requirements

The degree of Doctor of Philosophy in Infrastructure and Environmental Systems is awarded for completion of scholarly research that advances the knowledge base in the field of that research. Evidence of this is demonstrated by a successful dissertation defense. In addition, recipients of the degree should demonstrate a mastery of relevant subject matter and a potential for success in research and teaching.

The regular track of the INES Ph.D. program requires a minimum of 72 post-baccalaureate credit hours including 12 hours of Common Core Courses, 12 hours of Specialized Electives, 18 hours of dissertation research, 30 hours of Directed Studies, and the completion of GRAD 8302 and GRAD 8990. A master's degree in an appropriate field consistent with the admission requirements may count up to 30 credit hours of transfer credit to fulfill a portion or all of the Directed Studies requirement, upon recommendation of the Program Director and upon approval by the Graduate School.

For students admitted to the Advanced Standing Track, the minimum requirement of credit hours is reduced to 42 credit hours by completing Core Courses (12 credit hours), Specialized Electives (12 credit hours), Dissertation Research (18 credit hours), and GRAD 8302 and GRAD 8990. The requirement of Directed Studies (30 credit hours) will be waived.

All doctoral students are required to complete GRAD 8302 and GRAD 8990 for responsible conduct of research and academic integrity, respectively.

For Students with a Master's Degree (Advanced Standing Track):

Common Core Courses (12 credit hours)

Advanced Infrastructure Systems Course (3 credit hours)

INES 8104 - Advanced Infrastructure Systems (3)

Environmental Systems Course (3 credit hours)

INES 8101 - Environmental Systems (3)

Or one of the following courses as a substitute:

EMGT 6910 - Forecasting Techniques, Methodologies, and Practice (3)
GEOG 8220 - Human-Environment Interactions (3)
GEOG 8222 - Quaternary Paleoenvironmental Sciences (3)
GEOL 6102 - Earth Systems Analysis: Paleoenvironments (3)
INES 8120 - Numerical Modeling of the Earth System (3)
INES 8201 - Environmental and Ecological Economics (3)
INES 8202 - Renewable Energy (3)
An equivalent course not listed above with approval of the Program Director

Interdisciplinary Elective Course (3 credit hours)

Select one of the following:

ARCH 6050 - Architectural Elective (3)
ECON 6112 - Graduate Econometrics (3)
EMGT 6952 - Engineering Systems Optimization (3)
GEOG 8223 - Landscape Assessment (4)
GRAD 8104 - Spatial Statistics (3)
INES 8202 - Renewable Energy (3)
MBAD 6962 - Energy Markets (3)
PPOL 8640 - Economic Analysis of Public Policy I (3)
An equivalent course not listed above with approval of the Program Director

Seminar Course (3 credit hours)

Repeat the following seminar course each Fall semester for a total of 3 credit hours:

INES 8690 - Seminar (1)

Specialized Elective Courses (12 credit hours)

Select four doctoral-level courses from the following:

INES 8000-8890 (excluding INES 8690)

Note: Non-INES doctoral-level courses may be substituted with approval of the Program Director.

Dissertation Research (18 credit hours)

INES 8999 - Doctoral Dissertation Research (1 to 9)
(maximum of 18 credit hours) (excluding INES 8998)

Degree Total beyond Master's Degree = 42 credit hours

For Students with a Bachelor's Degree or a Master's Degree Admitted to the Regular Track:

Common Core Courses (12 credit hours)

Advanced Infrastructure Systems Course (3 credit hours)

INES 8104 - Advanced Infrastructure Systems (3)

Environmental Systems Course (3 credit hours)

INES 8101 - Environmental Systems (3)

Or one of the following courses as a substitute:

EMGT 6910 - Forecasting Techniques, Methodologies, and Practice (3)
GEOG 8220 - Human-Environment Interactions (3)
GEOG 8222 - Quaternary Paleoenvironmental Sciences (3)
GEOL 6102 - Earth Systems Analysis: Paleoenvironments (3)
INES 8120 - Numerical Modeling of the Earth System (3)
INES 8201 - Environmental and Ecological Economics (3)
INES 8202 - Renewable Energy (3)
An equivalent course not listed above with approval of the Program Director

Interdisciplinary Elective Course (3 credit hours)
Select one of the following:
ARCH 6050 - Architectural Elective (3)
ECON 6112 - Graduate Econometrics (3)
EMGT 6952 - Engineering Systems Optimization (3)
GEOG 8223 - Landscape Assessment (4)
GRAD 8104 - Spatial Statistics (3)
INES 8202 - Renewable Energy (3)
MBAD 6962 - Energy Markets (3)
PPOL 8640 - Economic Analysis of Public Policy I (3)
An equivalent course not listed above with approval of the Program Director

Seminar Course (3 credit hours)
Repeat the following seminar course each Fall semester for a total of 3 credit hours:
INES 8690 - Seminar (1)

Specialized Elective Courses (12 credit hours)
Select four doctoral-level courses from the following:
INES 8000-8890 (excluding INES 8690)

Note: Non-INES doctoral-level courses may be substituted with approval of the Program Director.

Directed Studies Courses (30 credit hours)
Select from the following:
INES 8090 - Topics in Infrastructure and Environmental Systems (3)
INES 8890 - Doctoral Independent Study and Project (1 to 9) *(maximum of 9 credit hours)*
Transfer of graduate credit hours *(maximum of 30)*
ARCH 5000-8000
BIOL 5000-8300
CEGR 5000-8090
CHEM 5000-8200
ECON 5000-6902
EGMT 5000-6980
ESCI 5000-6900
GEOG 5000-8800
GEOL 5000-6800
ITCS 5000-8500
MEGR 5000-8900
STAT 5000-8800

Dissertation Research (18 credit hours)
INES 8999 - Doctoral Dissertation Research (1-9) *(maximum of 18 credit hours) (excluding INES 8998)*

Degree Total beyond Bachelor's Degree = 72 credit hours

Graduate Course Requirements

All courses taken for credit in the INES Ph.D. program shall be graduate level courses (6000/7000-level and 8000-level: graduate students only), and the majority shall be at the Ph.D. level (8000-level: Ph.D. students only). All designated INES 8000-level courses are open only to Ph.D. students. No credit is given in the INES program for graduate coursework completed at the combined undergraduate-graduate level (5000-level at UNC Charlotte), except for Directed Studies.

Common Core Courses
INES Ph.D. students participate in interdisciplinary activities throughout their program of study. Students begin with a set of four common core courses that teach them about key aspects of infrastructure and environmental systems present in all applications of INES. These common aspects are reflected in four course offerings (two core courses, one interdisciplinary elective, and one continuous seminar). Students must complete INES 8104 in their first year of study and, throughout the program, students participate in interdisciplinary seminars.
Specialized Elective Courses

It is recognized that doctoral degree study requires advanced knowledge of issues, the breadth of which depends on the context and objectives of the academic program. Both the infrastructure and the environment involve broad and multi-faceted issues. Beyond the core, a student needs to support doctoral research with enrollment in particular courses related to their research. For this reason, a minimum of 12 credit hours have been reserved for specialized electives. The objective of these specialized electives is to provide an opportunity for students, their advisors, and their doctoral committee to select a complementary set of specialized courses intended to support the student's area of interest and research.

Specialized Elective courses come from many fields and sub-fields of various academic disciplines to address the program's focus of INES design, technology, science, and management. Many acceptable courses are offered in various departments at the master's level and Ph.D. levels. Selected courses must be approved by each student's advisor and doctoral committee.

Directed Studies
In recognition of varying backgrounds, preparation, interests, and goals, each student may complete additional graduate credits through directed studies (transfer credit, courses, research, or individual study), with the consent of their advisor and doctoral committee. This category may include courses within a student's specialized area as well as courses outside the specialized area. Within the directed studies category, a student may complete a maximum of 9 credit hours of independent study toward the Ph.D. degree.

Dissertation Requirement
The INES doctoral program includes a maximum of 18 credit hours of dissertation credit (INES 8999). The number of research credits taken each semester must be

approved by the student's advisor and doctoral committee. If more than 18 credit hours of dissertation credit are needed, students should register for INES 8998.

Each student must complete and defend a dissertation based on a research program approved by the student's doctoral committee. The dissertation must be of high quality and represent an original piece of research that advances the body of knowledge in infrastructure and environmental systems. Oral presentation and successful defense of the dissertation before the student's doctoral committee in a forum open to the public is required.

A copy of the student's dissertation is made available to the graduate faculty of the program at least two weeks prior to the public defense. The dissertation must be written in a format acceptable to the Graduate School and shall satisfy all requirements and deadlines specified by the Graduate School. Students are strongly encouraged to publish in a refereed journal before graduation.

Advising

Upon acceptance into the INES Ph.D. program, a student is assigned an interim advisor by the Program Director. Within the first year in the program, each student selects a permanent doctoral research advisor. This selection is approved by the Program Director and Dean of the Graduate School. At any time, a student may request a change of initial supervisor or research advisor. These requests are submitted to the Program Director for consideration and action.

Plan of Study

Students who enter the Ph.D. Program must prepare a plan of study before the end of their second semester in the Program. The plan of study proposes a schedule for completion of all coursework by the student. Each plan is approved by the student's doctoral committee and the Program Director. Students are encouraged to monitor their study progress through DegreeWorks.

Qualifying Examination

Each student must complete a pre-qualifying examination, a qualifying examination and an oral defense of their research proposal. The written pre-qualifying examination is based solely on INES 8104. The written qualifying examination includes specialized elective courses and research areas selected by the student's advisor and the doctoral committee. This qualifying examination is administered by the student's doctoral committee. The oral defense of the research proposal is also administered by the student's doctoral committee and requires a presentation and defense by the student of their proposed research topic.

Students who enter the Ph.D. program directly from a baccalaureate program generally sit for the two written examinations before the end of their third post-baccalaureate year in the program; students who enter from a master's degree program must sit for the written examinations before the end of their second year in the program. To sit for these examinations, a student must have at least a 3.00 GPA and must have removed all deficiencies upon admission.

A student may attempt to pass each of these examinations and the oral defense no more than twice. Failure of any of these examinations and the oral defense a second time results in termination of enrollment in the Ph.D. program.

Doctoral Committee

Each student's Doctoral Committee comprises five members including a UNC Charlotte Graduate Faculty who acts as the Doctoral Research Advisor, three regular faculty members, and a Graduate Faculty Representative. The Doctoral Research Advisor shall chair the Doctoral Committee and works with the student to recommend the appointment of three regular members and may suggest another faculty to be the Graduate Faculty Representative or they may let the Graduate School to select the Representative. The entire committee shall be approved by the Program Director, with subsequent concurrence by the Dean of the Graduate School. Faculty serving as regular members should have expertise in the student's area of research. The Graduate Faculty Representative may or may not have expertise in the student's area of research.

The Doctoral Committee must be formed no later than the third semester of enrollment into the INES program. At least three of the Doctoral Committee members must be INES Program Faculty members. At least one of the four members must come from a different academic discipline, in order to reflect the interdisciplinary nature of the program. The inclusion of one member from outside UNC Charlotte is strongly encouraged, and this person must be eligible for appointment as an affiliated member of the UNC Charlotte Graduate Faculty.

Admission to Candidacy

After passing the qualifying examination, a student can propose a dissertation topic. A student advances to candidacy after the dissertation topic has been approved by the student's doctoral committee. Candidacy must be achieved at least 6 months before the degree is conferred. Students are encouraged to track their study progress toward degree requirements through DegreeWorks.

Application for Degree

Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in

the University Academic Calendar.

Research Opportunities
INES faculty members reside in the Departments of Civil and Environmental Engineering, Geography and Earth Sciences, Construction Management and Engineering Technology, Biological Sciences, Chemistry, Economics, Finance, and Systems Engineering and Engineering Management, as well as the School of Architecture. INES faculty members in these departments (and school) currently conduct research in their specialized areas of interest as well as in interdisciplinary areas (see current areas of research listed at the beginning of this catalog section). Several international universities collaborate with INES to implement joint supervision of doctoral research.

Other Requirements
Requirements for grades, transfer credits, residency, and time limits for completion match those described generally for the University. Various forms must be submitted to the Graduate School at various times by each INES student. Those forms include: Application for Transfer of Credit into a Graduate Degree Program, Appointment of Doctoral Committee, Qualifying Examination Report, Application for Candidacy, Application for Degree, Dissertation Defense Report for Doctoral Candidates, and Dissertation Submission and ETD Form. Refer to the appropriate sections of this *Catalog* and to the INES and Graduate School websites for details.

Financial Support
The INES program offers financial support in the form of assistantships and tuition grants as described below.

Assistantships
Research and teaching assistantships are available from the INES program on a competitive basis to qualified applicants/students.

Tuition Grants
The Graduate School provides some tuition support via a plan called GASP. Visit graduateschool.charlotte.edu/faculty-and-staff-resources/policies for details.

MECHANICAL ENGINEERING

- Ph.D. in Mechanical Engineering
- M.S. in Mechanical Engineering (MSME)
  - Dynamics and Control
  - Machine Learning in Mechanical Engineering
  - Metrology and Manufacturing
  - Motorsports and Automotive Engineering
  - Solid Mechanics and Materials Science
  - Thermal Science and Fluid Mechanics
  - Interdisciplinary Biomedical Engineering
- Graduate Certificate in Precision Metrology

Department of Mechanical Engineering and Engineering Science
mees.charlotte.edu

Ph.D. in Mechanical Engineering

The Department of Mechanical Engineering and Engineering Science offers multi-disciplinary programs leading to a Ph.D. in Mechanical Engineering degree in the areas of automotive engineering, biomedical engineering, computational modeling and simulation, materials science, manufacturing, and precision engineering. In addition, the Ph.D. in Mechanical Engineering program offers an Advanced Standing Option for students who have already earned a Master's degree in selected disciplines.

The objectives of the Ph.D. program are:
- To provide students with the opportunity to develop a breadth of knowledge in mechanical engineering so that they can adapt to the changing requirements of the technological workplace.
- To develop engineering researchers who can contribute to the development of new knowledge and the dissemination of best practices in academic, industrial, and government environments.
- To prepare graduates for personal and professional success, both as individuals and in team environments.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for study toward the Ph.D. program in Mechanical Engineering:

1) A master's degree in engineering or a closely allied field with a GPA of at least 3.5. Exceptional students

with only a baccalaureate degree may also be considered for admission to the Ph.D. program.
2) The applicant must receive a satisfactory Graduate Record Examination (GRE) General Test score.
3) Three letters of reference, at least two of which must be from faculty members. All three must be from professionals working in the applicant's field of interest.

Acceptability for admission is based upon the applicant's record and background as determined by the department.

GRE Waiver

The GRE requirement will be waived for the following applicants:

- Current UNC Charlotte undergraduate students who have earned a minimum 3.2 cumulative GPA and completed at least 75 earned credit hours
- Applicants who have earned a bachelor's degree with a minimum cumulative undergraduate GPA of 3.2 from an ABET-accredited program in a U.S. institution
- Applicants who have passed the FE exam and/or earned the PE license
- Applicants who have completed a master's degree in engineering or related fields, and earned a minimum graduate GPA of 3.5 from an ABET-accredited program in a U.S. institution

Application Deadline

Application deadlines are in accordance with UNC Charlotte Graduate School deadlines. However, to ensure full consideration for financial support, applications must be received by September 1 for Spring admission and February 1 for Fall admission.

Degree Requirements

1) Appointment of a Ph.D. advisor and formation of an advisory committee.
2) Development of a Ph.D. Plan of Study detailing all course and examination requirements.
3) Successful completion of the written qualifying examination.
4) Formation of a Dissertation Committee, presentation of a proposal for Ph.D. research, and admission to candidacy.
5) Successful defense of the Ph.D. Dissertation.

Within the first semester of being admitted into a Ph.D. program, the student should choose a Ph.D. advisor and form an advisory committee, consisting of the Ph.D. advisor, Associate Chair for Graduate Programs, and academic advisor. In conjunction with the advisory committee, the student will develop a Plan of Study to meet the Ph.D. program requirements of coursework and examinations and prepare to undertake original research leading to a dissertation of a quality that would be acceptable for publication of articles in peer-refereed professional journals.

Plan of Study

The Plan of Study must show at least 72 credit hours beyond the baccalaureate degree, including at least 45 credit hours of graduate coursework (6000-level or above), and 21 credit hours of dissertation research. All doctoral students must register for 8000-level courses when they are available. 5000-, 6000-, or 7000-level courses that do not have 8000-level counterparts may also be counted towards the doctoral degree if approved by the advisory committee. For students who do not possess appropriate bachelor's and/or master's degrees in engineering, additional coursework is expected. The specific course requirements are set by the student's advisory committee but must include: at least 6 credit hours of graduate mathematics (e.g., MEGR 8172, MEGR 8174, or MEGR 8175) and at least 18 credit hours of MEGR courses. Graduate courses from outside the department may be taken, but must be approved by the Associate Chair for Graduate Programs as part of the student's Plan of Study. Students are pre-approved to choose one of the following Graduate School courses: GRAD 8201, GRAD 8202, GRAD 8210, or GRAD 8212. The Plan of Study must be submitted to the department for review and approval no later than the second semester after admission to the Ph.D. program. All coursework must be completed within nine years from admission to the program.

Research Seminar

All Ph.D. students are required to register for MEGR 8000 each semester through completion of proposal defense. This 1 credit hour course is graded on a pass/unsatisfactory basis, and does not count toward the required 72 degree hours.

MEGR 8000 - Research Seminar (1)

Responsible Conduct of Research and Academic Integrity Courses

All Ph.D. students are required to complete GRAD 8990 in the first semester, and GRAD 8302 in the first or second semester. GRAD 8990 is a no credit and non-graded course. GRAD 8302 is a 2 credit hour course, graded on a pass/unsatisfactory basis, and does not count toward the required 72 degree hours.

GRAD 8302 - Responsible Conduct of Research (2)
GRAD 8990 - Academic Integrity (0)

Degree Total = 72 Credit Hours

Grade Requirements

A student is expected to achieve grades of A or B in all coursework taken for graduate credit and must have a

minimum GPA of 3.0 in order to graduate. An accumulation of more than two marginal C grades will result in termination of the student's enrollment in the graduate program. If a student makes a grade of U in any course, enrollment will be terminated.

The dissertation research is graded on a SP (satisfactory progress) or UP (unsatisfactory progress) basis and, therefore, will not be included in the cumulative average. The second time in which a grade of UP is earned will trigger a discussion between the student and Ph.D. advisor about lack of progress in the program. This discussion will include all possible recommendations from the Ph.D. advisor, such as pursuing a new topic, moving to a new advisor or even termination from the program. The advisor will discuss any recommendation to terminate a student for lack of progress with the Associate Chair for Graduate Programs prior to forwarding such a request to the Graduate School for consideration.

A graduate student whose enrollment has been terminated because of grades is ineligible to attend any semester or summer session unless properly readmitted to the graduate program. Readmission to the program requires approval of the Dean of the Graduate School upon the recommendation of the student's major department and the Engineering Doctoral Graduate Committee of the College of Engineering.

Residence Requirement

A student may satisfy the residency requirement for the program by completing 18 credit hours, either coursework or research credits, by study-in-residence during the academic year and during the summer terms, as long as the study is continuous. Study-in-residence is deemed to be continuous if the student is enrolled in one or more courses (including research/dissertation credit) in successive semesters until 18 credit hours are earned.

Qualifying Examinations

After completing two semesters in the Ph.D. program, students take qualifying exams in math and two topical areas, selected by the student and their Ph.D. advisor. The mathematics examination is based on content from the course, Engineering Analysis (this course is currently offered as MEGR 8174). Students must obtain 70% or above on the mathematics exam to pass.

The student and the Ph.D. advisor select the two areas for the topical exams. 70% or above is the passing grade in each of the two topic areas.

For each of the three exams, two outcomes are possible: Pass (70% or more) or Fail (69% or less). If the student fails any or all of the exams in the first attempt, they are either allowed to retake the failed exam(s) or terminated from the program. If the student fails any exam for the second time, this is sufficient grounds for termination from the program.

Dissertation

Dissertation Committee

After passing the qualifying exam, students should set up a Dissertation Committee of at least four graduate faculty members. Two of these four members shall be from a department other than the student's major. One of these external members shall be chosen by the student in consultation of their Ph.D. advisor, and the other member is appointed as the Graduate Faculty Representative by the Graduate School. The Ph.D. advisor serves as chair of the committee, must be a member of the Department of Mechanical Engineering and Engineering Science (MEES) graduate faculty, and ensures that the composition of the committee is appropriate. Committee members from outside the University must be appointed Associate Graduate Faculty members at UNC Charlotte. The Dissertation Committee must be approved by the Associate Chair for Graduate Programs. If there is need to change committee members later, a revised Committee form must be approved and submitted to the Graduate School.

Proposal Defense

Each student must present and defend a Ph.D. dissertation proposal after passing the qualifying exam, following the technical guidelines established by the department. The proposal defense is conducted by the student's Dissertation Committee and is open to MEES faculty and students. The student shall provide copies of the written proposal to the Committee members at least two weeks before the scheduled defense.

It is expected that the student make the proposal defense in the semester after the Qualifying Exam is passed; exceptions will be made at the discretion of the student's advisor with approval of the Associate Chair for Graduate Programs.

Ph.D. Candidacy

A doctoral student advances to Ph.D. candidacy after the dissertation proposal has been successfully defended.

Once the student has been admitted to candidacy, a tentative date for the dissertation defense should be agreed upon by the candidate and dissertation committee chair. The date should be realistic and allow ample time for completion and review of the dissertation.

Dissertation Defense

Evidence of a high degree of competence in scholarship, written exposition, independent inquiry, and the ability to organize and apply knowledge must be demonstrated by the student in the dissertation. The student makes a public defense of the dissertation at which time the dissertation,

as well as the student's knowledge of the field, is appropriate matter for examination by the student's advisory committee. The date of the defense must be publicly announced at least two weeks prior to the defense. Although questions may be asked by the general audience, evaluation of the dissertation defense is the sole responsibility of the advisory committee. The dissertation defense is graded on a Pass/Fail basis.

Progress Report and Evaluation

In January of every year, each student is required to submit a written progress report for the previous year, and the advisor(s) is required to submit a written evaluation of the student to the Associate Chair for Graduate Programs. A rubric is used for evaluation of progress. Failure to make satisfactory progress may result in discontinuation of the student's graduate assistantship and suspension from the program.

Advanced Standing Option

Admission Requirements

To be admitted into the Advanced Standing Option for the Ph.D. in Mechanical Engineering program, students must meet all the admission requirements of the Ph.D. above AND must have earned a master's degree in engineering or closely related fields (e.g., physics, computational mechanics). Only students who have earned a master's degree in these areas will be considered, no exceptions will be made. All other students should apply to the Ph.D. program above (without the Advanced Standing Option).

Additionally, students with a cumulative GPA less than 3.2 in their master's degree or more than 2 grades of C in their master's degree courses are not eligible for Advanced Standing Option. In this case, students have the option of requesting transfer of credit hours for individual courses with grades of B or above.

Degree Requirements

The degree requirements for the Advanced Standing Option are similar to the Ph.D. in Mechanical Engineering above except that students complete only 42 credit hours. No transfer credits are allowed under this program. The degree requirement is as follows:

- 21 credit hours minimum graduate coursework, of which at least 12 credit hours must be MEGR courses
- Students who have not satisfied the mathematics requirement (6 credit hours minimum) as part of their master's degree must complete that requirement as part of the coursework at UNC Charlotte (e.g., MEGR 8172, MEGR 8174, or MEGR 8175)
- MEGR 8999 - Doctoral Dissertation Research (21 credit hours minimum)
- All Ph.D. students are required to register for MEGR 8000 each semester through completion of proposal defense/eligibility to enroll in GRAD 9800 (a non-graded course but can satisfy the full-time enrollment requirement)
- All students are required to complete GRAD 8990 in the first semester, and GRAD 8302 in the first or second semester

A minimum of 42 credit hours are required to complete the degree under the Advanced Standing Option. Once the minimums stated above are satisfied, the remaining hours, if any, can be satisfied via elective coursework or research credit hours (MEGR 8999). Any courses outside the Department of Mechanical Engineering and Engineering Science requires departmental approval.

Qualifying Examination

Students who enter the Ph.D. program under the Advanced Standing Option must take the qualifying examination before the end of their third semester in the doctoral program.

M.S. in Mechanical Engineering

The Department of Mechanical Engineering and Engineering Science offers programs of study and research leading to the Master of Science in Mechanical Engineering (M.S.M.E.) and the Master of Science in Engineering (M.S.E.). The M.S.M.E program of study is for students who have completed a B.S.M.E. degree while the M.S.E. degree is for students who may not possess a baccalaureate degree in engineering.

The objectives of the M.S.M.E and M.S.E. program are:

- To provide our students with the opportunity to develop a breadth of knowledge in mechanical engineering so that they can adapt to the changing requirements of the technological workplace.
- To produce graduates who are able to practice as mechanical engineers with advanced skills and serve state, regional, and national industries.
- To prepare graduates for personal and professional success, both as individuals and in team environments

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the Department of Mechanical Engineering and Engineering Science (MEES) seeks the following from applicants to the Master's program in Mechanical Engineering:

- An earned undergraduate degree in Mechanical Engineering (B.S.M.E.) or a closely related field of engineering or sciences

  - Applicants with baccalaureate degrees in fields other than Mechanical Engineering (e.g., engineering technology, physics, mathematics, chemistry, etc.) are required to take additional post-baccalaureate courses to supplement the undergraduate curriculum and ensure success in graduate coursework and research. Remediation of certain deficiencies as specified by the department for each area of concentration. Such courses should be taken before applying for the M.S.M.E.
- A minimum undergraduate GPA of 3.0 on a 4.0 scale
- A satisfactory Graduate Record Examination (GRE) general test score
- Three letters of recommendation, at least one of which must be from faculty members. All three must be from professionals working in the applicant's field of interest.
- An acceptable TOEFL, IETLS, or Duolingo score as required by UNC Charlotte for international students

GRE Waiver

The GRE requirement will be waived for the following applicants:

- Current UNC Charlotte undergraduate students who have earned a minimum cumulative GPA of 3.2 and completed at least 75 earned credit hours
- Applicants who have earned a bachelor's degree with a minimum cumulative undergraduate GPA of 3.2 from an ABET-accredited program in a U.S. institution
- Applicants who have passed the FE exam and/or earned the PE license
- Applicants who have completed a master's degree in engineering or related fields, and earned a graduate GPA of 3.5 or higher from an ABET-accredited program in a U.S. institution

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

A total of 30 credit hours of approved graduate coursework are required. Students select one of the two following options after completing no more than 18 credit hours.

Option A: Thesis

Successful completion of 24 credit hours of graduate-level coursework and 6 credit hours of thesis research.

Coursework (24 credit hours)

Mathematics Courses (6 credit hours)

Select two of the following:

MEGR 7172 - Computational Methods in Engineering (3)
MEGR 7174 - Engineering Analysis I (3)
MEGR 7175 - Engineering Analysis II (3)

Concentration Courses (12 credit hours)

Complete 12 credit hours from one of the concentrations listed under Option B.

Elective Courses (6 credit hours)

Select 6 credit hours of Elective Courses from the list below under Option B. If more than 6 credit hours of elective courses are proposed to be taken from outside the Department of Mechanical Engineering and Engineering Science, approval from the Associate Chair for Graduate Programs is required.

Thesis (6 credit hours)

6 credit hours of thesis research is required.

MEGR 7991 - Graduate Master Thesis Research (1 to 6)

Plan of Study

Students must meet with their thesis advisor to formulate a plan of study and establish a thesis committee. The plan of study must be submitted after completing no more than 18 credit hours.

Thesis Committee

The student must establish a thesis committee that is composed of at least 3 members of the graduate faculty, with up to one member from outside the Department of Mechanical Engineering and Engineering Science. The faculty thesis advisor serves as the chairperson of the committee.

Admission to Candidacy

Students must hold a proposal defense for approval of their thesis topic (the proposal defense format is left to the discretion of the advisor).

Thesis Defense

A copy of the thesis should be distributed to each member of the program committee at least two weeks prior to the defense. Students should make a public announcement two weeks before the defense within the department to allow attendance by interested faculty members and students.

Option B: Non-Thesis/Project

Successful completion of 30 credit hours of graduate-level coursework.

Mathematics Courses (6 credit hours)

Select two of the following:

MEGR 7172 - Computational Methods in Engineering (3)
MEGR 7174 - Engineering Analysis I (3)
MEGR 7175 - Engineering Analysis II (3)

Concentration Courses (12 credit hours)

Declare a concentration and take 12 credit hours of courses listed in that concentration:

Dynamics and Control Concentration

Select four of the following:

MEGR 5143 - Mechanical Vibrating Systems (3)
MEGR 5237 - Introduction to Control Systems (3)
MEGR 7145 - Advanced Topics in Dynamics (3)
MEGR 7148 - Stability and Control of Nonlinear Systems (3)
MEGR 7222 - Mechatronics (3)
MEGR 7223 - Mathematical Concepts for Dynamics and Control (3)
MEGR 7224 - Analytical Mechanics (3)

Machine Learning in Mechanical Engineering Concentration

The Machine Learning in Mechanical Engineering concentration consists of foundational courses offered by other departments (i.e., non-MEGR courses), and discipline-specific courses offered by the MEES department (i.e., MEGR courses). Currently, the discipline-specific courses are offered as special topics courses each semester. In consultation with the academic advisor or Associate Chair for Graduate Programs, select two MEGR discipline specific courses and two non-MEGR foundational courses from the following:

MEGR 7090 - Special Topics in Mechanical Engineering (3)
MEGR 7090 - Special Topics in Mechanical Engineering (3)
EMGT 6113 - Cluster Analysis and Applications (3)
EMGT 6912 - Computational Intelligence (3)
EMGT 6952 - Engineering Systems Optimization (3)
ITCS 5111 - Introduction to Natural Language Processing (3)
ITCS 6156 - Machine Learning (3)

Metrology and Manufacturing Concentration

Select four of the following:

MEGR 5280 - Advanced Manufacturing Processes (3)
MEGR 6181 - Engineering Metrology (3)
MEGR 7182 - Machine Tool Metrology (3)
MEGR 7191 - Introduction to Optical Fabrication and Testing (3)
MEGR 7283 - Advanced Coordinate Metrology (3)
MEGR 7284 - Advanced Surface Metrology (3)

Motorsports and Automotive Engineering Concentration

Select four of the following:

MEGR 5210 - Automotive Powerplants (3)
MEGR 5211 - Road Vehicle Dynamics (3)
MEGR 5240 - Advanced Automotive Powerplants (3)
MEGR 5242 - Applied Vehicle Aerodynamics (3)
MEGR 5244 - Tire Mechanics (3)
MEGR 7136 - Automotive Materials (3)
MEGR 7214 - Turbulent Shear Flows (3)
MEGR 7215 - Turbulence Modeling and Simulations (3)

Solid Mechanics and Materials Science Concentration

Select four of the following:

MEGR 6141 - Theory of Elasticity I (3)
MEGR 6166 - Mechanical Behavior of Materials I (3)
MEGR 7108 - Finite Element Analysis and Applications (3)
MEGR 7163 - Materials Characterization and Analysis (3)
MEGR 7172 - Computational Methods in Engineering (3)
MEGR 7173 - Engineering Design Optimization (3)

Thermal Science and Fluid Mechanics Concentration

Select four of the following:

MEGR 7113 - Dynamics and Thermodynamics of Compressible Flow (3)
MEGR 7114 - Advanced Fluid Mechanics (3)
MEGR 7117 - Statistical Thermodynamics (3)
MEGR 7213 - Introduction to Computational Fluid Dynamics (3)
MEGR 7214 - Turbulent Shear Flows (3)
MEGR 7215 - Turbulence Modeling and Simulations (3)

Interdisciplinary Biomedical Engineering Concentration

In consultation with the academic advisor or Associate Chair for Graduate Programs, select four courses from different concentrations and courses listed below.

MEGR 5271 - Orthopedic Biomechanics (3)
MEGR 5272 - Mechanics of the Human Locomotor System (3)
MEGR 5273 - Regenerative Neural Engineering (3)
MEGR 5274 - Bioelectronic Medicine (3)
MEGR 7119 - Thermal Applications in Biomedical Engineering (3)

Dual Concentration

Students may request to complete two concentrations. However, an additional 12 credit hours are required with no course double-counting toward two concentrations.

Elective Courses (9 credit hours)

Select three of the following. No more than 6 credit hours may be taken from outside the Department of Mechanical Engineering and Engineering Science. No more than 6 credit hours may be in Individual Study.

Any MEGR 5000, 6000, or 7000-level course
ECGR 6115 - Optimal Control Theory (3)

EMGT 6924 - Lean Six Sigma Practice and Management (3)
ENER 6120 - Energy Generation and Conversion (3)
NANO 8102 - Nanoscale Phenomena (3)
NANO 8104 - Fabrication of Nanomaterials (3)
NANO 8301 - Nanomedicine (3)
NANO 8351 - Nanoscale Materials for Energy Applications (3)
NANO 8354 - Solar Applications of Nanomaterials (3)
OPTI 5371 - Waves and Optics (3)
OPTI 6206 - Physical Optics Design and Simulation (3)
OPTI 6241 - Optical System Function and Design (3)

Capstone Course (3 credit hours)

A capstone course has a class project component. No capstone course can be double-counted to also satisfy a Concentration or Elective Course requirement. With prior approval from the Associate Chair for Graduate Programs, an offering of MEGR 7892 that includes a project may be approved to count as the required capstone course.

Select one of the following:
MEGR 7108 - Finite Element Analysis and Applications (3)
MEGR 7172 - Computational Methods in Engineering (3)
MEGR 7173 - Engineering Design Optimization (3)
MEGR 7186 - Data Analysis and Uncertainty (3)
MEGR 7213 - Introduction to Computational Fluid Dynamics (3)
MEGR 7214 - Turbulent Shear Flows (3)
MEGR 7215 - Turbulence Modeling and Simulations (3)
MEGR 7222 - Mechatronics (3)
MEGR 7284 - Advanced Surface Metrology (3)

Plan of Study

Students must formulate and submit a plan of study. The plan of study must be submitted after completing no more than 18 credit hours.

Degree Total = 30 Credit Hours

Grade Requirements/Academic Standards

Only grades of A, B, or C are accepted towards a graduate degree. A grade of U in any graduate course will suspend the student's enrollment subject to readmission as prescribed in the *Graduate Catalog*. Similarly, an accumulation of three C grades will result in suspension of the student's enrollment, subject to readmission to a program. A student in any graduate program is required to maintain satisfactory progress toward the degree. Continued enrollment is at all times subject to review on the basis of academic record and actions with regard to observance of University rules and regulations.

Application for Degree

Students preparing to graduate must submit an online Application for Degree by the filing data specified in the University Academic Calendar. If a student does not graduate in the semester identified on the Application for Degree, then the student must submit a new Application for Degree for graduation in a subsequent semester.

Assistantships

Financial assistance for qualified students is available on a competitive basis in the form of graduate teaching and research assistantships. All M.S. students who entered "Yes" in the application form on the question "Assistantship Interest" are automatically considered. No separate assistantship application is required.

Transfer Credit

At the time of admission, up to six hours of transfer credit may be accepted from an ABET-accredited engineering institution. Transfer courses are considered as Elective Courses unless a direct replacement of a Core Course is warranted.

Graduate Certificate in Precision Metrology

The Graduate Certificate in Precision Metrology provides graduate students and professionals with the opportunity to reach a demonstrated level of competence in dimensional metrology theory and application beyond the undergraduate level and "bench experience."

Students are introduced to topics directly related to dimensional metrology and its application in industrial settings. Together, these advanced course topics provide students with broader knowledge of the field of metrology and exposure to advanced techniques in dimensional measurement and analysis of data.

The graduate certificate may act as a standalone graduate option for post-baccalaureate and post-master's students, or may be pursued concurrently with a related graduate degree program at UNC Charlotte. The 12 credit hours in the graduate certificate may be applied toward the M.S. in Mechanical Engineering with approval of the Graduate Program Director.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the Department of Mechanical Engineering and Engineering Science seeks the following:

1) Either:
   a) A bachelor's degree in engineering or a closely related technical or scientific field, or
   b) Undergraduate coursework that includes engineering fundamentals (e.g., solids, statics, and dynamics)

2) A GPA of 3.0 (out of 4.0)
3) Applicants should submit written description of any relevant and significant work experience, especially as it pertains to metrology
4) Applicants whose native language is not English need to satisfy the UNC Charlotte Graduate School's English proficiency requirements

Certificate Requirements

The certificate is awarded upon completion of four graduate level courses (12 credit hours) in the area of metrology. Requests for related course substitutions may be approved at the discretion of the Graduate Program Director.

Required Courses (6 credit hours)

MEGR 6181 - Engineering Metrology (3)
MEGR 7182 - Machine Tool Metrology (3)

Students also enrolled in a Ph.D. program should substitute the following:
MEGR 8181 - Engineering Metrology (3)
MEGR 8182 - Machine Tool Metrology (3)

Elective Courses (6 credit hours)

Select two of the following:
MEGR 7183 - Design of Precision Machines and Instruments I (3)
MEGR 7185 - Gear Manufacturing and Metrology (3)
MEGR 7186 - Data Analysis and Uncertainty (3)
MEGR 7187 - Flexures (3)
MEGR 7191 - Introduction to Optical Fabrication and Testing (3)
MEGR 7283 - Advanced Coordinate Metrology (3)
MEGR 7284 - Advanced Surface Metrology (3)

Note: Students also enrolled in a Ph.D. program should substitute the following 8000-level equivalent courses:
MEGR 8183 - Design of Precision Machines and Instruments I (3)
MEGR 8185 - Gear Manufacturing and Metrology (3)
MEGR 8186 - Data Analysis and Uncertainty (3)
MEGR 8187 - Flexures (3)
MEGR 8191 - Introduction to Optical Fabrication and Testing (3)
MEGR 8283 - Advanced Coordinate Metrology (3)
MEGR 8284 - Advanced Surface Metrology (3)

Certificate Total = 12 Credit Hours

Transfer Credit

If any of the above courses are taken prior to admission to the certificate program, the student may, with the recommendation of their advisor and the approval of the Graduate School, apply a maximum of 6 graduate credit hours acceptably completed toward the certificate.

Grade Requirements

The cumulative GPA must be at least 3.0 and at most one course with a grade of C may be allowed toward the certificate.

College of Health and Human Services

health.charlotte.edu

In the College of Health and Human Services at the University of North Carolina at Charlotte, students and faculty help chart the course for healthcare and social services throughout the region. With excellence in educational programs, research, community service, and clinical practice, the college plays an important role in developing and implementing high quality healthcare and social service practices. As an interdisciplinary college, many opportunities exist for student and faculty collaboration in teaching and research. Within the college's diverse graduate curricula, faculty and student research also is a key component to successful student-learning outcomes. Additionally, the college incorporates information technology standards in all courses and offers online learning opportunities in many of its graduate programs.

Graduate Degree Programs

- Doctor of Nursing Practice: Post-Master's
- Doctor of Nursing Practice: Nurse Anesthesia Across the Lifespan
- Doctor of Philosophy in Health Services Research
- Doctor of Philosophy in Public Health Sciences
- Master of Health Administration (MHA)
- MHA/MBA Dual Degree *(see Belk College of Business section)*
- Master of Science in Athletic Training
- Master of Science in Kinesiology
- Master of Science in Nursing: Adult-Gerontology Acute Care Nurse Practitioner
- Master of Science in Nursing: Community/Public Health Nursing
- Master of Science in Nursing: Family Nurse Practitioner Across the Lifespan
- Master of Science in Nursing: Nurse Administrator
- Master of Science in Nursing: Nurse Educator
- Master of Public Health (MPH)
- MPH/M.A. in Anthropology Dual Degree
- Master of Science in Health Informatics and Analytics *(see the "School of Data Science" section of this Catalog)*
- MPH/M.S. in Health Informatics and Analytics Dual Degree
- Master of Science in Respiratory Care
- Master of Social Work

Graduate Non-Degree Programs

- Graduate Certificate in Applied Nursing Informatics
- Graduate Certificate in Early Childhood Mental Health *(see College of Education section)*

- Graduate Certificate in Gerontology *(see College of Liberal Arts & Sciences section)*
- Graduate Certificate in Health Informatics and Analytics *(see the "School of Data Science" section of this Catalog)*
- Graduate Certificate in Nursing Administration
- Graduate Certificate in Nursing Education
- Graduate Certificate in Respiratory Care Clinical Concepts
- Graduate Certificate in Respiratory Care Leadership
- Post-Master's Certificate in Adult-Gerontology Acute Care Nurse Practitioner
- Post-Master's Certificate in Family Nurse Practitioner Across the Lifespan

Accreditation

See the "Academic Programs" section of this Catalog for details about program accreditation.

APPLIED PHYSIOLOGY, HEALTH, AND CLINICAL SCIENCES

- M.S. in Athletic Training
- M.S. in Kinesiology
  - Applied Physiology
  - Clinical Exercise Physiology
  - Strength and Conditioning
- M.S. in Respiratory Care
- Graduate Certificate in Respiratory Care Clinical Concepts
- Graduate Certificate in Respiratory Care Leadership

Department of Applied Physiology, Health, and Clinical Sciences

aphcs.charlotte.edu

Master of Science in Athletic Training

The M.S. in Athletic Training prepares students for national certification and licensure as a certified athletic trainer with career opportunities in high schools, colleges/universities, orthopedic and sports medicine clinics, business and industry, professional sports teams, government health agencies, branches of the U.S. military, and research laboratories.

The emphases of the curriculum are: evidence based practice, risk management and injury prevention, pathology of injuries and illnesses, acute care of injuries and illnesses, pharmacology, therapeutic modalities, therapeutic exercise, general medical conditions and disabilities, nutritional aspects of injuries and illnesses, psychosocial intervention and referral, healthcare administration, and professional development and responsibilities. Students are given opportunities to gain knowledge and skills needed to pass the certification exam of the Board of Certification (BOC) for Athletic Training.

Admission Requirements

In addition to fulfilling the University's general requirements for graduate admission at the Master's level, applicants seeking admission to the MSAT program must also have:

1) Overall undergraduate cumulative GPA of 3.0 (on a 4.0 scale) in all college coursework
2) Grades of C or above in the following prerequisite courses:
    a) Human Anatomy with laboratory
    b) Human Physiology with laboratory
    c) Chemistry with laboratory
    d) Physics with laboratory
    e) Statistics
    f) Exercise Physiology
    g) Psychology
    h) Nutrition
    i) Biomechanics
    j) Medical Terminology
    k) Introduction to Biology
3) 50 hours of observation shadowing a certified athletic trainer
4) For non-native English language speakers: Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS)
5) Statement of Purpose; 500 to 1000 words describing the applicant's educational goals and expectations of the program

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

Successful completion of the program requires a total of 58 credit hours of coursework (21 courses). All students participate in clinical rotations. These clinical rotations are assigned to the students based on required competencies and proficiencies for accreditation purposes. There are skills assessed during these clinical rotations that follow the didactic course in which they are instructed. These are requirements of accreditation by the Commission on Accreditation of Athletic Training Education (CAATE).

ATRN 6100 - Acute and Emergency Care in Athletic Healthcare (3)
ATRN 6101 - Clinical Anatomy for Allied Health (3)
ATRN 6102 - Fundamentals in Athletic Training (3)
ATRN 6104 - Clinical Evaluation and Diagnosis of the Lower Extremity (3)
ATRN 6105 - Therapeutic Modalities (3)
ATRN 6106 - Therapeutic Exercise Techniques (3)
ATRN 6107 - Foundations of Modern Healthcare (3)
ATRN 6109 - Clinical Evaluation and Diagnosis of the Upper Extremity (3)
ATRN 6110 - Clinical Evaluation and Diagnosis of the Head and Spine (3)
ATRN 6111 - Therapeutic Interventions (3)
ATRN 6113 - Patient-Centered Healthcare (3)
ATRN 6114 - General Medicine and Pharmacology I (3)
ATRN 6118 - Administration for Healthcare Professionals (3)
ATRN 6119 - General Medicine and Diagnostic Procedures (3)
ATRN 6121 - Behavioral Health in Sports Medicine (3)
ATRN 6400 - Introduction to Clinical Care (1)
ATRN 6401 - Clinical Rotation I (1)
ATRN 6402 - Clinical Rotation II (1)
ATRN 6403 - Clinical Rotation III (1)
ATRN 6405 - Clinical Rotation IV (3)
ATRN 6406 - Clinical Rotation V (6)

Degree Total = 58 Credit Hours

Advising

Each student in the MSAT program must have a major advisor, the Graduate Program Director for the MSAT program.

Assistantships

Due to clinical hour requirements, there are no assistantships available to students in the MSAT program.

Master of Science in Kinesiology

The Master of Science in Kinesiology program prepares graduate students to advance the fields of Kinesiology through evidenced-based patient care and translational research. The program emphasizes basic and clinical interdisciplinary education and research in areas of kinesiology.

The M.S. in Kinesiology offers three concentrations within the program which also include a clinical (thesis optional) and research (thesis required) degree option.

Admission Requirements

In addition to fulfilling the University's general requirements for graduate admission at the Master's level, applicants seeking admission in to the M.S. in Kinesiology program must also:

1) Possess an overall cumulative GPA of 2.5 or above in all college coursework and possess an overall GPA of 3.25 on all upper division coursework (courses completed in the Junior and Senior year of the undergraduate program)
2) Present satisfactory grades (C or above) on specific prerequisite courses
    a) The Applied Physiology concentration requires a minimum of 4 credit hours of Anatomy and

Physiology, 3 credit hours of Exercise Physiology, and 3 credit hours of Statistics.

b) The Clinical Exercise Physiology concentration requires a minimum of 4 credit hours of Anatomy and Physiology, 3 credit hours of Exercise Physiology, 3 credit hours of Exercise Testing, and 3 credit hours of Statistics.

3) Present satisfactory scores on the Test of English as a Foreign Language (TOEFL), if the applicant is from a non-English speaking country.
4) Demonstrate evidence of sufficient interest, ability, and preparation in Kinesiology to adequately profit from graduate study, as determined by the Kinesiology Graduate faculty. This information should be included in the statement of purpose and specifically speak to the following: a) strengths, b) concentration of interest, c) career aspirations, and d) research interests (if pursuing the Applied Physiology concentration).

Note: Standardized test scores (e.g., GRE, MAT) are not required.

The deadline to change concentrations is April 1 of the first year within the program.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

Select one of the concentrations. Each concentration requires 36 credit hours approved by the Department of Applied Physiology, Health, and Clinical Sciences. A minimum of 15 credit hours presented for the degree must be courses numbered 6000 and above. The concentrations require the same 12 credit hours of core courses, but differ in their specific courses and the number of elective hours. Courses for which undergraduate credit has been awarded may not be repeated for graduate credit. At the time of admission, up to 6 credit hours of graduate transfer credit may be accepted if approved by the Department of Applied Physiology, Health, and Clinical Sciences and the Graduate School.

Applied Physiology Concentration (Thesis required)

The Applied Physiology (AP) concentration is excellent preparation for those planning to continue their education through the Ph.D. level, either in Kinesiology or a related field (Biology, Rehabilitation Sciences, Physiology, etc.). Students selecting this concentration are also well qualified for employment in aspects of the health industry or in research labs.

Core Courses (12 credit hours)

KNES 5115 - Research Methods in Kinesiology (3)
KNES 5232 - Physiology of Human Aging (3)
KNES 6280 - Advanced Exercise Physiology (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)

Required Concentration Courses (15 credit hours)

KNES 6171 - Advanced Biomechanics (3)
KNES 6800 - Directed Independent Study (3)
KNES 6900 - Research and Thesis in Kinesiology (6)
RSCH 6110 - Descriptive and Inferential Statistics (3)
or STAT 6127 - Introduction to Biostatistics (3)

Elective Concentration Courses (9 credit hours)

Acceptable elective courses include any KNES course or GRAD course at or above the 6000 level, as well as any graduate level course at or above the 6000 level offered within the College of Health and Human Services or any of the other colleges.

Clinical Exercise Physiology Concentration (Thesis optional)

The Clinical Exercise Physiology (CEP) concentration is a CAAHEP-accredited program that is designed to prepare students to become Registered Clinical Exercise Physiologists. Clinical Exercise Physiologists are employed in inpatient and outpatient clinical/rehabilitation settings (e.g., Cardiopulmonary Rehab programs), general wellness/fitness commercial and corporate settings, and industrial settings that provide health care services for both diseased and healthy populations. Through a blend of classroom instruction and clinical experience, the degree program teaches a wide variety of specific healthcare skills, knowledge, and behaviors within the cardiovascular, pulmonary, metabolic, neoplastic, musculoskeletal, neuromuscular, and immunologic practice areas.

Core Courses (12 credit hours)

KNES 5115 - Research Methods in Kinesiology (3)
KNES 5232 - Physiology of Human Aging (3)
KNES 6280 - Advanced Exercise Physiology (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)

Required Concentration Courses (18 credit hours)

KNES 6120 - Advances in Clinical Exercise Physiology (3)
KNES 6121 - Clinical Practice in Exercise Physiology (3)
KNES 6134 - Exercise Prescription for Cardiopulmonary and Metabolic Disorders (3)
KNES 6151 - Exercise Testing Methods (3)
KNES 6292 - Exercise Prescription for Musculoskeletal Disorders (3)
KNES 6490 - Advanced Practicum in Clinical Exercise Physiology (1) *(taken 3 times)*

Each Practicum credit is equivalent to 200 clinical hours. Clinical practicum usually begins in the third semester of the student's program and are arranged through the Practicum Coordinator within the Department of Applied Physiology, Health, and Clinical Sciences.

Elective Concentration Courses (6 credit hours)

Acceptable elective courses include any graduate course at or above the 6000 level. CEP students who opt to pursue a thesis take 3 credit hours of KNES 6900 as one of their electives.

Strength and Condition (S&C) Concentration

The modern Strength and Conditioning profession relies heavily on evidence-based research in implementing strength and conditioning programs. The curriculum for the active and available sports performance concentration consists of high quality instruction on cutting edge theoretical concepts related to strength and conditioning. The instructors are researchers trained and certified in strength and conditioning from professional organizations, including the National Strength and Conditioning Association (NSCA). In addition, students have practical requirements with exposure to innovative programming with Charlotte 49ers Athletics and successful community facilities. Since the majority of strength and conditioning positions require a master's degree with certifications from reputable organizations including NSCA, the Strength and Condition concentration produces highly qualified and marketable practitioners in career fields related to athletic performance.

Core Courses (6 credit hours)

KNES 5115 - Research Methods in Kinesiology (3)
KNES 6280 - Advanced Exercise Physiology (3)

Required Concentration Courses (27 credit hours)

KNES 5100 - Organization and Administration of Strength and Conditioning (3)
KNES 5333 - Sport and Exercise Psychology (3)
KNES 6151 - Exercise Testing Methods (3)
KNES 6171 - Advanced Biomechanics (3)
KNES 6260 - Clinical Exercise Nutrition (3)
KNES 6282 - Skeletal Muscle for Health and Disease (3)
KNES 6320 - Advanced Principles of Strength and Conditioning (3)
KNES 6340 - Periodization of Resistance Training (3)
KNES 6490 - Advanced Practicum in Clinical Exercise Physiology (1) *

**Note: KNES 6490 is taken three times. A capstone project and comprehensive examination occurs within the second Practicum.*

Elective Concentration Course (3 credit hours)

Select one KNES course at the 6000 level or above.

Comprehensive Examination

All candidates for the degree must pass a comprehensive examination.

Applied Physiology Concentration

Students selecting the Applied Physiology concentration must present credit for at least 6 credit hours of KNES 6900 and pass a thesis defense. Students who fail to maintain a thesis progression schedule as agreed with their thesis advisor may be released by their thesis advisor. If a student is released by their thesis advisor, they will have 1 academic month or until the end of the current term to find a new advisor. If a new advisor cannot be found, the student is removed from the program at the end of the current term.

Clinical Exercise Physiology Concentration

Students selecting the Clinical Exercise Physiology concentration have two attempts to pass the comprehensive examination. Students' first attempt is to pass the Clinical Exercise Physiologist examination (CEP), administered by the American College of Sports Medicine. The opportunity to take that exam will be scheduled. If students do not pass the CEP, their second attempt is the scheduled faculty-driven comprehensive examination. This examination is offered one time during the Fall and Spring semester, and is not offered during the Summer. If CEP concentration students are also doing work for a thesis, then they may present credit for at least 3 credit hours of KNES 6900 and pass a thesis defense. Failing the comprehensive competency exam, students are dismissed from the M.S. in Kinesiology program.

Strength and Condition Concentration

Students selecting the Strength and Conditioning concentration have two attempts to pass the comprehensive examination. Students' first attempt is to pass the Certified Strength and Conditioning Specialist (CSCS) or comparable test offered by The National Strength & Conditioning Association (NSCA). The opportunity to take that exam will be scheduled. If students do not pass the CSCS/comparable test, their second attempt is the scheduled faculty-driven comprehensive examination. This examination is offered one time during the Fall and Spring semester, and is not offered during the Summer. If S&C concentration students are also doing work for a thesis, then they may present credit for at least 3 credit hours of KNES 6900 and pass a thesis defense. Failing the comprehensive competency exam, students are dismissed from the M.S. in Kinesiology program.

Degree Total = 36 Credit Hours

Academic Standing

The M.S. in Kinesiology program follows all academic

standing, suspension, and appeal policies set forth by UNC Charlotte with one exception. The Department of Applied Physiology, Health, and Clinical Sciences requires that no course listed on a master's student's candidacy form be older than six years at the time of graduation. Courses that exceed this time limit must be retaken.

Advising

Each student in the M.S. in Kinesiology program must have a major advisor. Upon acceptance into the program, each student is assigned an advisor. For students in the AP concentration, the Graduate Program Director is the academic co-advisor along with the thesis advisor. For students in the CEP and S&C concentrations, the Graduate Program Director is the listed as the primary advisor. Students in the AP concentration work with their major advisor to develop an advisory committee. The advisory committee must have at least 3 members (including the major advisor) and the majority of which must be from the Department of Applied Physiology, Health, and Clinical Sciences. Any course substitutions must be approved by the academic advisor.

Assistantships

Positions as a graduate assistant or teaching assistant may be available. Grant funded assistantships may be available as well. Students seeking assistantships should contact the Graduate Program Director of the Kinesiology program. In general, applications for graduate assistantship awards for the academic year are made by the preceding February 1.

Continuous Registration

Students in graduate degree programs are required to maintain continuous registration (Fall and Spring semesters) for thesis, dissertation, project, or directed study until work is completed.

Financial Aid/Financial Assistance

A wide range of opportunities for financial aid/assistance is available to qualifying students, which may be accessed through the Office of Student Financial Aid. See the Financial Information section of this *Catalog* for more information on the opportunities that are available, and how to contact the Office of Student Financial Aid.

Grade Requirements

The M.S. in Kinesiology program follows all grading policies set forth by UNC Charlotte. A minimum grade point average of 3.0 is required on all coursework attempted for the degree. Students who receive two grades of C will be removed from the program and will need to successfully complete the appeal procedure. Please reference the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for specific information related to any grading policy questions. The grade of I is assigned at the discretion of the instructor when a student who is otherwise passing has not, due to circumstances beyond their control, completed all the work in the course. The missing work must be completed within 12 months (exact date determined by instructor) or the I will be changed to a U.

Program Certifications

Completion of the Clinical Exercise Physiology concentration qualifies the graduate to take the Clinical Exercise Physiology Examination (CEP) administered by the American College of Sports Medicine. Completion of the Strength and Conditioning concentration qualifies the graduate to take the Certified Strength and Conditioning Specialist certification administered by the National Strength and Conditioning Association.

Research Opportunities/Experiences

A range of research opportunities exist in the Department of Applied Physiology, Health, and Clinical Sciences for qualified students. Students are encouraged to become engaged in the research focus of the department.

Tuition Waivers

Tuition waivers may be available through a variety of sources. Students interested in pursuing tuition waivers should contact the Graduate Program Director in the semester prior to enrolling for courses.

Master of Science in Respiratory Care

The UNC Charlotte Master of Science in Respiratory Care (MSRC) program is a fully online program designed for respiratory care professionals. The program prepares respiratory therapists to advance the respiratory care profession through leadership and evidence-based practice. Students have the opportunity to pursue relevant topics that can be applied to current practice. The program provides graduates with additional knowledge, skills, and competencies that support advancement opportunities in clinical and educational leadership, scholarship and research, and disease management.

Admission Requirements

In addition to Graduate School admission requirements, admission requirements for acceptance into the program include:

- Bachelor's degree in Respiratory Therapy, related science, or social science from a college or university accredited by an accepted accrediting body
- Minimum GPA of 3.0 (on a 4.0 scale). If an applicant has earned or attempted a post-baccalaureate degree

(i.e., a master's, doctoral, or other), grades in that program will also be taken into consideration.
- Registered Respiratory Therapist (achieving and maintaining the RRT Credential offered by the National Board of Respiratory Care (NBRC))
- Current state license to practice Respiratory Therapy
- Professional experience consisting of at least 2 years of clinical Respiratory Therapy practice
- Written statement of the applicant's educational goals and expectations of the program
- Evidence of knowledge in the field from academic or professional colleagues or supervisors in the form of 2 reference letters

Documents that applicants must provide for application review include:

- Associate and Bachelor's degree transcripts
- Registered Respiratory Therapist (RRT Credential)
- Copy of current state license
- Statement of Purpose: 500 to 1000 words describing the applicant's educational goals and expectations of the program
- Two letters of recommendation from individuals with academic or professional knowledge of the applicant's capabilities

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The program requires the completion of 30 credit hours in approved courses.

RESP 5101 - Health Outcomes and Quality Assessment (3)
RESP 6101 - Respiratory Care Leadership (3)
RESP 6104 - Health Policy, Law, and Ethics in the Health Professions (3)
RESP 6105 - Pulmonary Function Testing and Cardiopulmonary Rehabilitation (3)
RESP 6106 - Ventilation Application and Monitoring (3)
RESP 6110 - Cardiopulmonary Disease Management (3)
RESP 6115 - Research Methods for Respiratory Care (3)
RESP 6601 - Emerging Issues in Respiratory Care Seminar (3)
or NURS 6282 - Interprofessional Collaboration in Healthcare (3)
RESP 6803 - Respiratory Care Capstone I (3)
RESP 6804 - Respiratory Care Capstone II (3)

Degree Total = 30 Credit Hours

Student Learning Outcomes

Students are required to successfully complete all direct effectiveness measures for the four Student Learning Outcomes to complete the program:

1) **Leadership:** Students apply leadership theories and evidence-based practice concepts to plan and make collaborative and effective decisions relevant to respiratory care services or education.
2) **Evidence-Based Practice:** Students conduct scholarly activities using evidence-based practice concepts, research methodology, and statistical procedures relevant to study of or application to respiratory care.
3) **Professional Communication:** Students develop culturally competent and effective oral and written communication for professional interactions.
4) **Cardiopulmonary Disease Management:** Students develop evidence-based care plans in the prevention, diagnosis, treatment, and management of patients with cardiopulmonary diseases.

Graduate Certificate in Respiratory Care Clinical Concepts

This is a Distance Education program.

The Graduate Certificate in Respiratory Care Clinical Concepts is designed to provide additional knowledge and skills on advanced diagnostic and therapeutic clinical concepts in the care of patients with cardiopulmonary disorders. The Graduate Certificate is 100% online and requires the completion of 12 credit hours of courses.

Admission Requirements

- Bachelor's degree in respiratory therapy, related health science, or social science from a college or university accredited by an accepted accredited body
- Registered Respiratory Therapy (RRT) Credential in good standing
- Respiratory Care Practitioner State License in good standing
- Minimum GPA of 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- Online application through the Graduate School's application system
- Statement of purpose
- Unofficial transcripts of all college coursework attempted

Certificate Requirements

Required Courses (12 credit hours)

RESP 6105 - Pulmonary Function Testing and Cardiopulmonary Rehabilitation (3)
RESP 6106 - Ventilation Application and Monitoring (3)
RESP 6110 - Cardiopulmonary Disease Management (3)
RESP 6115 - Research Methods for Respiratory Care (3)

Certificate Total = 12 Credit Hours

Grade Requirements

- A minimum 3.0 GPA is required to graduate with the certificate
- No more than one course with a grade of C; courses graded as C on the certificate plan of study must be offset by an equal number of graduate-level credits graded as A
- Courses with a grade of C cannot be transferred to the M.S. in Respiratory Care program; the course will need to be repeated if enrolled in the MSRC program

Graduate Certificate in Respiratory Care Leadership

This is a Distance Education program.

The Graduate Certificate in Respiratory Care Leadership is designed to provide additional knowledge and skills in the application of leadership, quality assessment, and health policy concepts in the healthcare environment. The Graduate Certificate is 100% online and requires the completion of 12 credit hours of courses.

Admission Requirements

- Bachelor's degree in respiratory therapy, related health science, or social science from a college or university accredited by an accepted accredited body
- Registered Respiratory Therapy (RRT) Credential in good standing
- Respiratory Care Practitioner State License in good standing
- Minimum GPA of 2.75 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- Online application through the Graduate School's application system
- Statement of purpose
- Unofficial transcripts of all college coursework attempted

Certificate Requirements

Required Courses (9 credit hours)

RESP 5101 - Health Outcomes and Quality Assessment (3)
RESP 6101 - Respiratory Care Leadership (3)
RESP 6104 - Health Policy, Law, and Ethics in the Health Professions (3)

Elective Course (3 credit hours)

Select one of the following:

NURS 6282 - Interprofessional Collaboration in Healthcare (3)
RESP 6601 - Emerging Issues in Respiratory Care Seminar (3)

Certificate Total = 12 Credit Hours

Grade Requirements

- A minimum 3.0 GPA is required to graduate with the certificate
- No more than one course with a grade of C; courses graded as C on the certificate plan of study must be offset by an equal number of graduate-level credits graded as A
- Courses with a grade of C cannot be transferred to the M.S. in Respiratory Care program; the course will need to be repeated if enrolled in the MSRC program

HEALTH ADMINISTRATION

- Master of Health Administration (MHA)
- MHA/MBA Dual Degree *(see the Belk College of Business section)*
- MHA/M.S. in Health Informatics and Analytics Dual Degree

Department of Public Health Sciences
publichealth.charlotte.edu

Master of Health Administration (MHA)

The Master of Health Administration (MHA) program develops healthcare leaders prepared to advance health equity and well-being in an urbanizing world.
This mission is pursued through education, research, and service that:

1) Gives students the knowledge, skills, and values needed to lead dynamic health systems.
2) Creates knowledge needed to lead people and organizations providing health services.
3) Increases the diversity of health services leaders, with a special emphasis on individuals and groups historically underrepresented in graduate education.
4) Promotes the public's health.

Vision Statement
The Master of Health Administration program is to be the premier program in developing healthcare leaders who promote healthy communities partnered with responsive population health systems.

Values Statement
The program values collaboration, community engagement, diversity, innovation, professionalism, health equity, and social justice.

Job Opportunities
Master's prepared health services managers may work as chief or executive administrator, assistants to chief executives, or as directors and managers of departments and units. Examples of the settings where MHA graduates work include: hospitals and hospital systems, physician practices and clinics, long-term care facilities, managed care organizations, consulting firms, pharmaceutical and biotechnology companies, local/state/federal health agencies, health insurance companies, and medical supply and equipment manufacturers.

Admission Requirements
Applicants are invited from a variety of undergraduate degree specializations who share in the program's mission and vision.

A portfolio approach is used to evaluate applicants. An applicant's portfolio consists of reference letters, previous professional experience (resume), goal statement, and transcripts (undergraduate and previous graduate work, if applicable). The portfolio approach allows for a holistic assessment of applicants for potential success in the program. Applicants should have a cumulative GPA of at least a 3.0, or make a compelling case for their capacity as part of their essay (goal statement).

Expectations
In meeting the application requirements set forth by the Graduate School, applicants are expected to:

- Provide a resume as part of their application materials
- Have mastered basic computer skills, including word processing and use of spreadsheets
- Select recommenders who can reflect on their prior academic and/or professional performance and capability for success in the graduate program
- Convey their demonstrated and potential capacity for verbal, quantitative, and analytical reasoning through their transcripts, statement of purpose, and letters of recommendation
- Applicants should consider potential gaps in such evidence when preparing their statements and soliciting letters of recommendation to put forth a compelling case in support of their admission.

Applicants are encouraged to review the competitive profile of our applicants and to consult with the MHA Program Director if concerned about meeting expectations.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
Each student is required to complete a total of 51 credit hours, including 45 credit hours (15 courses, including the Internship) in the core curriculum. These courses offer a basic body of knowledge, skills, and values relevant to

health services administration. Additionally, students select 6 credit hours (2 graduate courses) in elective studies.

Core Courses (42 credit hours)

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HADM 6104 - Health and Disease (3)
HADM 6108 - Decision Analysis in Healthcare (3)
HADM 6116 - Accounting for Healthcare Management (3)
HADM 6120 - Health Economics (3)
HADM 6124 - Marketing in Healthcare (3)
HADM 6128 - Human Resources Management (3)
HADM 6134 - Quality and Outcomes Management in Healthcare (3)
HADM 6138 - Healthcare Finance (3)
HADM 6142 - Health Policy Development (3)
HADM 6145 - Organization Behavior in Healthcare (3)
HADM 6146 - Information Resources Management (3)
HADM 6150 - Health Law and Ethics (3)
HADM 6154 - Strategic Management of Health Services Organizations (3)

Internship (3 credit hours)

Each student in the program is required to apply classroom lessons in practice through an approved internship. Proof of immunizations, a criminal background check, and a drug screen are among commonly imposed internship requirements. Students who are unable to be placed in an internship face dismissal from the program.

HADM 6400 Health Administration Internship (3)

Elective Courses (6 credit hours)

Students should select two elective courses that complement their professional interest and educational goals. Elective courses are available in a variety of areas, including health informatics and analytics, management specialties, long-term care, community health, and nonprofit organization. Students may choose from elective courses offered by the program or avail themselves of any graduate offerings from across the University that may be open to them. Sample courses include:

HADM 6200 - Health Insurance and Managed Care (3)
HADM 6210 - Medical Practice Management (3)
HADM 6212 - Health, Aging, and Long Term Care (3)
HADM 6216 - Long Term Care Administration (3)
HADM 6204 - Trends and Issues in Health Administration (3)
HADM 6234 - Performance Improvement Project Management in Healthcare: An Introduction to Lean Six Sigma (3)
GRNT 6211 - Administration of Aging Programs (3)
SOCY 6138 - Social Organization of Healthcare (3)

Degree Total = 51 Credit Hours

Advising

Each student is assigned a faculty advisor. In addition, the MHA Program Director serves as the back-up advisor for all students. Registration for MHA courses is by permission only and follows a proscribed sequence. Consequently, students are required to meet with their advisor on a regular basis to plan their progression through their program of study. Course substitutions are sparingly allowed and must be approved by the MHA Director in advance.

Assistantships

Positions as graduate teaching assistants or student temporary hires (formerly known as graduate administrative assistants) may be available. Grant-funded research assistantships may be available as well. Students seeking assistantships should contact the MHA Program Director.

Financial Aid/Financial Assistance

A wide range of opportunities for financial aid/assistance is available to qualifying students, which may be accessed through the Office of Student Financial Aid. See the Financial Information section of this Catalog for more information on the opportunities that are available, and how to contact the Office of Student Financial Aid.

MHA/MBA Dual Degree

This dual degree program allows students to earn a Master of Health Administration (MHA) degree from the College of Health and Human Services and a Master of Business Administration (MBA) degree from the Belk College of Business. For details, see the Belk College of Business section of this *Catalog*.

MHA/M.S. in Health Informatics and Analytics Dual Degree

The Master of Health Administration (MHA) and Professional Science Master's in Health Informatics and Analytics (HIA PSM) dual degree program allows students to earn both a Master of Health Administration and a M.S. in Health Informatics and Analytics degree. The MHA and HIA PSM dual degree program (outlined below) consists of 66 credit hours of coursework, in contrast to the 87 credit hours required if these degrees were pursued separately.

Admission Requirements

Both programs' admissions committees review applicants to the dual degree program. Applicants might be offered admission into only the individual MHA or HIA PSM

programs instead of the dual degree program. Similarly, students admitted into the dual degree program may opt to matriculate into only the MHA or HIA PSM program. Students having matriculated into either the MHA or HIA PSM program desiring to add the dual degree must apply and gain admission to the dual degree no later than the end of their first semester of matriculation into either program.

Degree Requirements

Blended Core Courses (57 credit hours)

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HADM 6104 - Population Health and Disease (3)
HADM 6116 - Accounting for Healthcare Management (3)
HADM 6120 - Health Economics (3)
HADM 6124 - Marketing in Healthcare (3)
HADM 6128 - Human Resources Management (3)
HADM 6134 - Quality and Outcomes Management in Healthcare (3)
HADM 6138 - Healthcare Finance (3)
HADM 6142 - Health Policy Development (3)
HADM 6145 - Organization Behavior in Healthcare (3)
HADM 6146 - Information Resources Management (3)
HADM 6150 - Health Law and Ethics (3)
HCIP 5376 - Introduction to Programming for Health Informatics (3)
HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6108 - Intermediate Decision Analysis in Healthcare (3)
HCIP 6160 - Big Data Design, Storage, and Provenance in Healthcare (3)
HCIP 6201 - Health Information Privacy and Security: Law, Ethics, and Technology (3)
HCIP 6380 - Introduction to Health Informatics (3)

Plus one of the following:

HCIP 5122 - Visual Analytics (3)
HCIP 6392 - Enterprise Health Information Systems (3)
HCIP 6393 - Health Data Integration (3)
HCIP 6396 - Business Intelligence in Healthcare (3)

Internship (3 credit hours)

Students pursue a single internship relevant to both Health Administration and Health Informatics and Analytics.

HADM 6400 - Health Administration Internship (3)

Capstone Courses (6 credit hours)

Complete both programs' respective capstone courses:

HADM 6154 - Strategic Management of Health Services Organizations (3)
HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)

Degree Total = 66 Credit Hours

HEALTH SERVICES RESEARCH

- Ph.D. in Health Services Research

Department of Public Health Sciences

publichealth.charlotte.edu

Ph.D. in Health Services Research

This interdisciplinary program in Health Services Research includes coursework in biostatistics, health economics, healthcare organizational structures and processes, epidemiology, health policy, personal behaviors, and social factors that affect access to healthcare, quality and cost of healthcare, and health outcomes. Graduates are prepared to conduct interdisciplinary research utilizing quantitative methods supplemented with qualitative methods to advance knowledge to support innovations in healthcare delivery systems and health policy. All students are required to complete a series of core and area of emphasis courses individually developed between the student and their advisor. The cornerstone of the program is the student's dissertation, which is expected to be a significant contribution based on original and independent research leading to publications in peer reviewed, indexed journals. Graduates are prepared to work in healthcare delivery systems, academia, or government positions.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for study in the Ph.D. in Health Services Research program:

- Master's Degree in a health-related field from a college or university accredited by an accepted accrediting body
- An overall graduate GPA of at least 3.5 out of 4.0 from a graduate program from a college or university accredited by an accepted accrediting body
- Graduate Record Examination (GRE) test scores; visit the Ph.D. in Health Services Research program website for details
- An essay addressing professional and academic experiences, motivation for pursuing the degree, specialty area of emphasis to pursue in the program, and how the program fits the applicant's career plans. The essay should also identify how the applicant's research interests align with those of at least two members of the HSR Ph.D. Program or Participating Faculty.

- A current curriculum vitae (CV)
- Three letters of reference, at least one of which is from a former graduate faculty member
- A score on the Test of English as a Foreign Language (TOEFL) examination, which meets University requirements for those applicants whose native language is not English
- Completed at least one graduate level course with a grade of B or above in each of the following areas:
    - Statistics or biostatistics
    - Health policy
    - Epidemiology
    - Foundational public health knowledge

  Note: Applicants will be considered for admission if they have not completed the prerequisite graduate courses. If admitted, students must consult with the Program Director to determine when to take these prerequisites during the course of their studies. Graduates of a CEPH accredited degree program are waived from the foundational public health knowledge requirement. Master's level courses taken to fulfill the prerequisite requirements are not counted toward the 61 credit hour total for the Ph.D.
- An interview with the Director or the Director's designee and potential mentor(s) either in person or by telephone may be requested

Degree Requirements

The Ph.D. acknowledges the value of coursework for background and preparatory to conducting research. The program requires 61 post-master's credit hours. This program emphasizes courses in research methods and analysis, as well as experiences working with faculty on research to support the development of research skills in order to carry out the dissertation on a significant research problem in the area of health services research.

Professional Roles and Responsibilities Courses (7 credit hours)

HLTH 8601 - Ethics and Integrity in Health Research and Practice (3)
HSRD 8600 - Seminar in Health Services Research (1) *(taken for four semesters)*

Theory Courses (12 credit hours)

HSRD 8201 - Introduction to Health Services Research (3)
HSRD 8202 - Healthcare Systems and Delivery (3)
HSRD 8203 - Economics of Health and Healthcare (3)
HSRD 8204 - Health Policy (3)

Methods Courses (12 credit hours)

HLTH 8270 - Applied Biostatistics: Regression (3)
HLTH 8271 - Applied Biostatistics: Multivariate Methods (3)
HSRD 8260 - Design of Health Services Research (3)
HSRD 8261 - Healthcare Program Evaluation, Outcomes, and Quality (3)

Area of Interest Courses (12 credit hours)

Students design an area of emphasis in consultation with their advisor, subject to the Graduate Program Director's approval. The area of emphasis should align with the student's intended research focus. The area of emphasis must include at least two of the methodology courses listed below (or alternatives approved by the Graduate Program Director). The remaining courses should provide added depth relevant to the area of emphasis (e.g., methods, health issue, population), and may be at the master's or doctoral level.

HLTH 6260 - Analytic Epidemiology (3)
HLTH 8221 - Qualitative Research in Behavioral Sciences (3)
HLTH 8282 - Health Survey Design and Research (3)
HLTH 8603 - Teaching Portfolio (3)
HSRD 8262 - Large Data Sets and Health Services Research (3)
HSRD 8263 - Advanced Data Analysis for Health Services Research (3)

Dissertation (18 credit hours)

HSRD 8901 - Dissertation Research (3, 6, or 9)

Degree Total = 61 Credit Hours

Grade Requirements

Students must maintain a cumulative average of 3.0 in all coursework taken in the program. The seminars are graded on a Pass/Unsatisfactory basis and, therefore, are not included in the cumulative average. An accumulation of two C grades results in termination of a student's enrollment in the doctoral program. A second failure in any of the following results in dismissal from the program: the qualifying examination; the dissertation proposal defense; or final dissertation defense. If a student receives a grade of U or NC in any course, enrollment is terminated. A doctoral student whose enrollment has been terminated due to grades is ineligible to register in any semester or summer session.

Dissertation

Dissertation Process

Dissertation Chair Selection

The student selects a Dissertation Chair. The Chair must be a member of the HSR Ph.D. Program Faculty, or a member of the HSR Ph.D. Participating Faculty with a co-Chair who is a member of the Program Faculty. Students should consult with their faculty advisor and the Program Director as they develop their plans for selecting the dissertation committee chair, and for forming the dissertation committee. The student should work closely with the Chair on identifying other committee members, and typically should approach other faculty about serving on the committee only after consulting with the Chair.

Dissertation Committee Selection
The student selects the Dissertation Committee, which must be at least 4 members. Three must be from the HSR Ph.D. Program Faculty or Participating Faculty (one of whom is the Chair). The student submits the "Appointment of Doctoral Dissertation Committee" form. The Graduate School appoints the 4th member. The four members of the dissertation committee will serve as the student's committee for the refinement of the dissertation topic, the development and defense of the dissertation proposal, the development of the dissertation, and dissertation defense.

Dissertation Topic Selection
The Chair of the dissertation committee and the student together select the dissertation topic. The Chair is responsible to ensure that all members of the committee are actively involved and agree to the direction and the specifics of the proposal (e.g., data, methods). Ensuring this involvement and agreement is a major goal of the Topic Approval Meeting. When the Chair approves the topic and approach to the dissertation, the student schedules the Topic Approval Meeting with the Dissertation Committee. The student submits a 2-3 page description of the dissertation plan to the Dissertation Committee at least 2 weeks prior to the Topic Approval Meeting. This single-spaced description of the topic includes the following sections: (1) Background and Significance, (2) Hypotheses and Specific Aim, and (3) Methods. The Topic Approval Meeting is not typically open to visitors. Students will present a brief oral summary of: the dissertation topic, the context of related research literature, data and methods, and implications for policy and practice, followed by questions.

Dissertation Proposal
Following the topic approval, the student writes the dissertation proposal and prepares for the Oral Proposal Defense. Students should consult with their Dissertation Chair and Committee early in the process to determine whether the "traditional" or "three manuscript" approach is most applicable to their proposed dissertation research. Regardless of the approach selected, the dissertation proposal should contain the following elements:

- Introduction - This chapter should highlight the importance of the problem to health services research and the significance of the proposed research.
- Literature Review - This chapter should critically review and synthesize literature relevant to the proposed topic. It may be appropriate to include a conceptual or biological model to further position the research questions to be explored.
- Hypotheses and Specific Aims
- Methods - This chapter should include information on the study design, study population, measurement of variables, and statistical analysis plan. For the proposal, this chapter should also contain information on study strengths, limitations, and potential implications. Please note that this information will be incorporated into a different chapter for the final dissertation.
- References - Students should consult with their Dissertation Chair regarding what citation style to use.
- Appendix - This chapter is optional but may include dummy tables, questionnaires, informed consent forms, data request forms, or other relevant information that is referenced in an earlier chapter.

If students plan on using the "three manuscript" approach they should also include a brief description of the three manuscripts they will produce and relate them to their hypotheses and specific aims. Students should also list target journals for these manuscripts. For the proposal, this information can be included within Chapter 3. For additional information on the "three manuscript" approach, please consult the Graduate School website.

Students are expected to meet with their Dissertation Chairs on a regular basis to discuss their dissertation research. Students and Dissertation Chairs should consult with the Dissertation Research Credit Application that they completed together to ensure that appropriate progress is being made during the semester. All members of the committee must receive the full proposal at least 2 weeks before the Proposal Defense.

Oral Defense of the Dissertation Proposal
The submission of the proposal is followed by the Oral Proposal Defense. In the HSR Ph.D. program, the Oral Proposal Defense is open to faculty and students. The student must provide the title of the proposed dissertation, and the date, time, and location of the Oral Proposal Defense to the Program Director no later than two weeks prior to the Oral Proposal Defense.

The student should prepare a PowerPoint presentation approximately 25 minutes in length summarizing the research proposal. Following the student's presentation, the committee will ask questions about the research plan. The student will be excused from the meeting to permit the committee to discuss the merits of the proposal, after which the student will return to the meeting to receive the committee's comments and required modifications to the research plan. After successful completion of the Oral Proposal Defense, the student submits two forms: (1) "Proposal Defense Report for Doctoral Dissertation and/or Master's Thesis/Project " and (2) "Exam Report of Comprehensive/Qualifying Examination, Portfolio Presentation, and Study Report for Master's and Doctoral Students."

Advancement to Candidacy
A doctoral student advances to candidacy after the dissertation proposal has been approved by the student's

Dissertation Committee and the Graduate School. Candidacy must be achieved at least one term prior to the term of graduation.

Dissertation Research

Completion of the dissertation is the final component of the doctoral degree. A doctoral dissertation must demonstrate the candidate's ability to conceive, design, conduct, and interpret independent, original, and creative research, and must make a unique contribution to knowledge in the field of health services research. Under the direct supervision of the Dissertation Committee Chairs, students are encouraged to consult regularly with their Dissertation Committee members during the planning, conducting, and writing of the dissertation. The dissertation defense is a public defense. Notice of the location and time will go to the campus community.

Following the approval of the dissertation topic and advancement to doctoral candidacy, students are required to maintain continuous enrollment in HSRD 8901 for dissertation study until work is completed. Continuous enrollment begins in the semester after the dissertation topic is approved.

Qualifying Examination

The qualifying examination will take place at least once per year. Students sit for the qualifying examination after completion of their Theory, Methods, and Professional Roles and Responsibilities core coursework. The qualifying examination consists of three sections: 1) Methods section, 2) Theory section, and 3) Integrative section. The examination must be taken and passed prior to enrollment in dissertation research credit hours (HSRD 8901).

Specific procedures regarding the grading of the qualifying examination are detailed in the *Health Services Research Ph.D. Student Handbook*.

Time Limits for Completion

All requirements for the degree must be completed within nine years after the first registration as a doctoral student or the registration for any course transferred into the program toward degree requirements. The student must receive admission to candidacy within 6 years after admission to the program and complete all requirements within 6 years of admission to candidacy for the Ph.D. degree. These time limits are maximums; students will be typically expected to complete the degree requirements within 5 years.

Transfer Credit

Only courses with grades of A or B may be accepted for transfer credit. A maximum of 6 hours of transfer credit for post-Master's coursework earned from a college or university accredited by an accepted accrediting body within the previous five years may be accepted with the Graduate Program Director's approval. Only courses appropriate for the program and curriculum in which the student is enrolled may be transferred.

UNC Charlotte Residency Requirement

The student must satisfy the UNC Charlotte residency requirement for the program by completing 21 credit hours. Residence is considered to be continuous if the student is enrolled in one or more courses in successive semesters until 21 hours are earned.

NURSING

- Doctor of Nursing Practice (DNP)
  - Post-Master's
  - Nurse Anesthesia Across the Lifespan
- Master of Science in Nursing (MSN)
  - Adult Psychiatric Mental Health Nursing *(inactive; not currently being offered)*
  - Adult-Gerontology Acute Care Nurse Practitioner
  - Community/Public Health Nursing
  - Family Nurse Practitioner Across the Lifespan
  - Nurse Administrator
  - Nurse Anesthesia Across the Lifespan *(not accepting new applicants)*
  - Nurse Educator
- Graduate Certificate in Nursing
  - Applied Nursing Informatics
  - Nurse Administrator
  - Nurse Educator
- Post-Master's Certificate in Nursing
  - Adult-Gerontology Acute Care Nurse Practitioner (AGACNP)
  - Family Nurse Practitioner Across the Lifespan

School of Nursing
nursing.charlotte.edu

Doctor of Nursing Practice (DNP) – Post-Master's

The Post-Master's Doctor of Nursing Practice (DNP) degree prepares graduates to analyze systems of care and provide transformational leadership to improve patient safety, quality of care, and implement evidence-based culturally competent care practices. Graduates from this program are able to interpret and apply research findings to practice settings, determine and measure system and population outcomes, manage information systems, and use appropriate technology for health and risk communication.

Upon completion of the DNP program, graduates are able to:

- Analyze and integrate evidence from nursing science with evidence from other relevant scientific disciplines to form a scientific foundation for advanced practice in nursing.
- Apply clinical scholarship, scientific evidence, and analytical methods to improve health care outcomes.
- Develop and evaluate systems to enhance safety and quality of healthcare.
- Advocate and participate in collaborative interdisciplinary efforts to improve health outcomes at the practice/organization, community, state, and national levels.
- Engage in culturally competent and ethically sound advanced nursing practice.
- Demonstrate leadership in the improvement of patient outcomes and transformation of health care delivery.
- Manage directly the complex problems of clients/populations and systems to facilitate access and navigation of the health care system to improve health outcomes.

Courses are taught in a hybrid format. Students are expected to travel to campus and participate in campus immersion activities when scheduled.

Admission Requirements

- An overall GPA of at least 3.5 (on a 4.0 scale) in the MSN program as documented by official transcripts
- Earned master's or higher degree in nursing in an advanced nursing practice specialty from a college or university accredited by an accepted accrediting body
- Current RN licensure in the U.S. at time of application with eligibility for NC licensure; NC licensure must be obtained prior to clinical practice experiences in NC
- GRE/MAT scores are not required for applicants to the Post-Master's DNP Program
- Advanced Practice Registered Nurses (APRNS) must provide evidence of current national certification and meet the state requirements for practice in their state of licensure
- An essay that addresses: 1) advanced practice expertise, 2) career goals, 3) how earning the DNP degree will foster achievement of these goals, and 4) plans for DNP project
- Resume/curriculum vitae
- Three professional recommendations that address the practice capabilities of the candidate
- For international students: submission of TOEFL scores with a minimum score of 557 for the paper test and 83 Internet-based test
- Additional evidence for consideration of the application can be uploaded (e.g., publications, posters, evidence-based practice projects)
- Evidence of 500 supervised clinical hours within the MSN program (to be completed by MSN program officials); applicants who do not meet the clinical hours criteria can meet with the DNP Coordinator to discuss a plan to meet the requirement
- Faculty interview with qualified applicants
- UNC Charlotte School of Nursing will no longer enroll a student with a master's in nursing education unless they are pursuing an advanced practice role; specifically, Nurse Practitioners, Nurse Midwifery,

Nurse Anesthetist, Clinical Nurse Specialist, Clinical Nurse Leaders or Nurse Informaticists

Degree Requirements

The DNP program requires 42 post-master's graduate credit hours and completion of a total of 1000 clinical practice hours (includes 500 hours from the MSN program).

Core Courses (18 credit hours)

NUDN 8140 - Foundations and Applications of Evidence-Based Practice (3)
NUDN 8145 - Leadership and Project Planning (3)
NUDN 8202 - Community Epidemiology (3)
NUDN 8220 - Healthcare Policy and Ethics (3)
NUDN 8230 - Economic and Financial Aspects of Healthcare System (3)
NUDN 8270 - Technology for Communication and Transforming Healthcare (3)

Concentration Courses

Theory Courses (9 credit hours)

NUDN 8160 - Global Health and Social Justice (3)
NUDN 8260 - Leadership and Healthcare Systems (3)
Graduate Elective Course (3)*

**The Graduate Elective Course may be selected from Nursing courses, but any graduate level course is acceptable.*

Methods Courses (6 credit hours)

NUDN 8147 - Applied Biostatistics (3)
NUDN 8150 - Healthcare Program Evaluation and Quality (3)

Residency and Project Courses (9 credit hours)

NUDN 8441 - Clinical Residency and Project Development I (2)
NUDN 8442 - Clinical Residency and Project Development II (2)
NUDN 8443 - Clinical Residency and Project Development III (3)
NUDN 8444 - Clinical Residency and Project Development IV (2)

Degree Total = 42 Credit Hours

Grade Requirements

An accumulation of three C grades in any graduate coursework will result in suspension of the student's enrollment. If a student makes a grade of U or N in any credit-bearing graduate course, enrollment will be suspended.

Clinical Residency and DNP Scholarly Project

Project Description

Students complete a DNP Scholarly Project in conjunction with their clinical residency or project development courses. The DNP Scholarly Project is a project that brings together the practice and scholarship aspects of the Doctor of Nursing Practice degree. It is designed to address complex practice issues that affect groups of patients, healthcare organizations, or healthcare systems while utilizing informatics, technology, and in-depth knowledge of the clinical and behavioral sciences. The clinical scholarship required in the DNP Scholarly Project reflects mastery and competency in the student's area of expertise.

The DNP Scholarly Project continues throughout the program, culminating in a scholarly public defense. The DNP Scholarly Project requires students to demonstrate expert practice, the use of evidence-based practice, translational research, and use of skills necessary to lead interdisciplinary teams to improve patient/client outcomes and health status individually, organizationally, or within a community. Students may choose to work in settings related to their specialty practice.

Project Approval

The DNP Scholarly Project is guided by the DNP Scholarly Project Committee. The composition of the DNP Scholarly Project committee includes: 1) a chair who is a doctoral-prepared faculty member in the School of Nursing with regular graduate faculty status at UNC Charlotte; 2) a clinical expert (Ph.D., DNP, M.D., or other doctoral prepared individual); 3) one additional faculty member; and 4) a faculty member appointed by the Graduate School at UNC Charlotte. It is the responsibility of the DNP Scholarly Project Committee to guide the student through project planning, implementation, and evaluation process.

Upon approval of the DNP Scholarly Project topic, the student begins to develop the project. Once the project development is complete, the student presents to the committee and DNP faculty the final proposal for the project. The student's DNP Scholarly Project proposal serves as the primary component of the qualifying examination for the DNP program. To be eligible to defend the DNP Scholarly Project proposal, a student must have completed the written proposal and orally presented the proposal to the committee. This written and oral presentation is used to evaluate if the student is prepared and qualified to begin work on the project.

Institutional Review Board Approval

The DNP Scholarly Project must be collectively agreed upon by the student, the practice setting, and the student's DNP Scholarly Project Committee. Prior to beginning the DNP Scholarly Project, the project may require approval

of the UNC Charlotte Institutional Review Board (IRB) and Institutional Review Board at the agency where the project will be conducted. If required, all IRB requirements must be fulfilled prior to launching the project. Any additional agency requirements must be completed prior to beginning implementation of the project.

Project Defense

After completion of the DNP Scholarly Project, the student orally defends the written project to the Project Committee in a public defense. The outcome of the project defense is pass or no pass. The student is allowed two attempts to present/defend the DNP scholarly project. Failure to successfully defend after two attempts results in dismissal from the program. Details regarding timelines and benchmarks in conducting and defending the project are available in the *DNP Student Handbook*.

Student Handbooks

The policies and procedures guiding the program, progression, and expectations can be found in the *Graduate Student* and *DNP Student Handbooks*.

Time Limits for Degree Completion

All graduation requirements must be completed within 6 years after enrollment in the first course.

Transfer Credit

DNP students may transfer up to 6 graduate credit hours (with a grade of B or above) with approval of the DNP Graduate Program Director. No course being transferred may be older than 6 years at the time of graduation or have counted toward completion of another degree.

Doctor of Nursing Practice (DNP) – Nurse Anesthesia Across the Lifespan

The Nurse Anesthesia Across the Lifespan is a post-baccalaureate DNP concentration requiring a BSN to apply. It provides students both the theory and clinical practice required to meet the educational requirements to take the national certifying examination upon graduation The specialty in Nurse Anesthesia Across the Lifespan is offered in partnership with Carolinas Medical Center. Clinical experiences are offered at Atrium Health facilities in the Charlotte area. This program is full-time, campus-based, and can be completed in 9 semesters. Students are admitted once per year and begin their program of study in the summer semester. Interviews are conducted for the top candidates two times per academic year. Application is required at both UNC Charlotte and Carolinas Medical Center School of Nurse Anesthesia. All application materials must be received prior to the published deadline.

The Doctor of Nursing Practice (DNP) is the terminal practice degree in Nursing. The DNP prepares students to practice in an advanced clinical role and provide leadership in a dynamic healthcare system. Graduates of the program will be able to analyze systems of care and provide leadership to improve patient safety and quality of care and to implement evidence-based, culturally competent care. Visit nursing.charlotte.edu and atriumhealth.org/education/Graduate-Medical-Education/School-of-Nurse-Anesthesia for information on application deadlines and program metrics.

Admission Requirements

- Hold a current unrestricted RN licensure in the U.S. at the time of application with eligibility for NC licensure
- Earned Baccalaureate Degree in Nursing (BSN) from a college or university accredited by an accepted accrediting body
- Graduate Record Exam (GRE) scores no older than 5 years; a minimum combined score of 293 on the verbal and quantitative sections is recommended (MAT scores are not accepted)
- A minimum GPA of 3.3 on a 4.0 scale for all undergraduate work after high school
- A minimum GPA of 3.3 on a 4.0 scale for all basic undergraduate science courses taken since high school (e.g., Chemistry, Biology, Anatomy and Physiology, and Microbiology)
- Completion of an undergraduate statistics course with a grade of B or above
- An essay (statement of purpose) limited to a single page, describing the applicant's experience, fit to the CRNA role, and examples of leadership; candidates should highlight unique characteristics such as being bilingual and leadership experiences
- Three letters of recommendation from persons familiar with the applicant's professional qualifications, one letter must be from the applicant's clinical manager; others can include colleagues, academic professors, or physicians
- A minimum 18 months of current full-time critical care experience with adult patients is required prior to matriculation; Acceptable experience includes: Intensive Care Unit, Coronary Care Unit, Trauma Intensive Care Unit, Neuro Intensive Care Unit, Surgical Intensive Care Unit, Cardiovascular Intensive Care Unit. Experiences that are not acceptable include: Flight Team, Emergency Room, Pediatric Intensive Care Unit, Neonatal Intensive Care Unit, Post Anesthesia Care Unit, and Operating Room
- Current certification in Basic Cardiac Life Support, Advanced Cardiac Life Support, and Pediatric Advanced Life Support with documentation provided only to Carolinas Medical Center Nurse Anesthesia Program application

- Interviews are required for the top-scoring applicants who meet the admission requirements. Top scoring applicants will be invited for an interview with the Program's Admissions Committee. Only after a successful interview, will applicants be offered admission.
- Professional resume
- The application process requires two applications - one to UNC Charlotte and one to Carolina's Medical Center

Degree Requirements

The Nurse Anesthesia Across the Lifespan DNP program requires completion of 89 credit hours of approved courses, completion of a minimum of 2000 clinical practice hours, and completion of the Scholarly Project. Only full-time study is available. All courses are offered once a year and must be taken in sequence.

Core Courses (18 credit hours)

NUDN 8140 - Foundations and Applications of Evidence-Based Practice (3)
NUDN 8145 - Leadership and Project Planning (3)
NUDN 8202 - Community Epidemiology (3)
NUDN 8220 - Healthcare Policy and Ethics (3)
NUDN 8230 - Economic and Financial Aspects of Healthcare System (3)
NUDN 8270 - Technology for Communication and Transforming Healthcare (3)

Concentration Courses

Theory Courses (25 credit hours)

NUAN 8154 - Advanced Pharmacology of Non-Anesthetic Agents (4)
NUAN 8155 - Advanced Pharmacology of Anesthetic Agents (4)
NUAN 8156 - Applied Physics and Chemistry in Nurse Anesthesia (3)
NUAN 8157 - Advanced Pathophysiology in Nurse Anesthesia I (3)
NUAN 8158 - Advanced Pathophysiology in Nurse Anesthesia II (3)
NUAN 8171 - Professional Aspects of Nurse Anesthesia (3)
NUAN 8172 - Nurse Anesthesia Review (2)
NURS 6273 - Advanced Human Physiology (3)

Methods Courses (21 credit hours)

NUAN 8161 - Principles of Nurse Anesthesia I (3)
NUAN 8162 - Principles of Nurse Anesthesia II (3)
NUAN 8163 - Principles of Nurse Anesthesia III (3)
NUAN 8164 - Principles of Nurse Anesthesia IV (3)
NUDN 8302 - Responsible Conduct of Research and Scholarship in Nursing Practice (2)
NURS 6230 - Advanced Health Assessment and Diagnostic Reasoning for Advanced Practice (3)
NURS 6430 - Advanced Health Assessment and Diagnostic Reasoning Practicum (1)
STAT 6127 - Introduction to Biostatistics (3)

Clinical Residency Courses (19 credit hours)

NUAN 8484 - Clinical Residency in Nurse Anesthesia I (1)
NUAN 8485 - Clinical Residency in Nurse Anesthesia II (2)
NUAN 8486 - Clinical Residency in Nurse Anesthesia III (4)
NUAN 8487 - Clinical Residency in Nurse Anesthesia IV (4)
NUAN 8488 - Clinical Residency in Nurse Anesthesia V (4)
NUAN 8489 - Clinical Residency in Nurse Anesthesia VI (4)

Scholarly Project Courses (6 credit hours)

NUDN 8641 - Project Development I (1)
NUDN 8642 - Project Development II (2)
NUDN 8643 - Project Development III (1)
NUDN 8644 - Project Development IV (2)

Clinical Requirements

Students are required to successfully complete a minimum of 2000 hours of supervised clinical. Atrium Health provides clinical instruction for students enrolled in the nurse anesthesia program. The primary location for clinical is Carolinas Medical Center, an 850-bed Level-1 Trauma Center and regional referral center for North and South Carolina. The medical center and teaching hospital provides students state-of-the-art clinical facilities and access to patients undergoing a variety of complex surgical and diagnostic procedures. All facilities provide a preceptor-to-student ratio of no more than 1 to 2 with a CRNA and/or physician anesthesiologist. The clinical hours and number and variety of cases are exceptional; students far exceed the number of clinical hours and cases required for certification.

Degree Total = 89 Credit Hours

Grade Requirements

To progress in the program, students must maintain a GPA of 3.0 in all coursework taken. More than one grade of C in non-specialty courses leads to student suspension. Progression in the concentration requires a grade of B or above in all concentration (NUAN) courses. A grade of C or below in any concentration course leads to dismissal from the major. In addition, students must successfully pass the Scholarly Project proposal defense and Scholarly Project defense in order to graduate.

Clinical Residency and DNP Scholarly Project

Project Description

Students complete a DNP Scholarly Project in conjunction with their clinical residency or project development courses. The DNP Scholarly Project is a project that brings together the practice and scholarship aspects of the Doctor of Nursing Practice degree. It is designed to address complex practice issues that affect groups of patients, healthcare organizations, or healthcare systems while utilizing informatics, technology, and in-depth

knowledge of the clinical and behavioral sciences. The clinical scholarship required in the DNP Scholarly Project reflects mastery and competency in the student's area of expertise.

The DNP Scholarly Project continues throughout the program, culminating in a scholarly public defense. The DNP Scholarly Project requires students to demonstrate expert practice, the use of evidence-based practice, translational research, and use of skills necessary to lead interdisciplinary teams to improve patient/client outcomes and health status individually, organizationally, or within a community. Students may choose to work in settings related to their specialty practice.

Project Approval

The DNP Scholarly Project is guided by the DNP Scholarly Project Committee. The composition of the DNP Scholarly Project committee includes: 1) a chair who is a doctoral-prepared faculty member in the School of Nursing with regular graduate faculty status at UNC Charlotte; 2) an expert clinical mentor (Ph.D., DNP, M.D. or other doctoral prepared individual; 3) one additional faculty member; and 4) a faculty member appointed by the Graduate School at UNC Charlotte. It is the responsibility of the DNP Scholarly Project Committee to guide the student through project planning, implementation, and evaluation process.

Upon approval of the DNP Scholarly Project topic, the student begins to develop the project. Once the project development is complete, the student presents to the committee and DNP faculty the final proposal for the project. The student's DNP Scholarly Project proposal serves as the primary component of the qualifying examination for the DNP program. To be eligible to defend the DNP Scholarly Project proposal, a student must have completed the written proposal and orally presented the proposal to the committee. This written and oral presentation is used to evaluate if the student is prepared and qualified to begin work on the project.

Institutional Review Board Approval

The DNP Scholarly Project must be collectively agreed upon by the student, the practice setting, and the student's DNP Scholarly Project Committee. Prior to beginning the DNP Scholarly Project, the project may require approval of the UNC Charlotte Institutional Review Board (IRB) and Institutional Review Board at the agency where the project will be conducted. If required, all IRB requirements must be fulfilled prior to launching the project. Any additional agency requirements must be completed prior to beginning implementation of the project.

Project Defense

After completion of the DNP Scholarly Project, the student orally defends the written project to the Project Committee in a public defense. The outcome of the project defense is pass or no pass. The student is allowed two attempts to present/defend the DNP scholarly project. Failure to successfully defend after two attempts results in dismissal from the program. Details regarding timelines and benchmarks in conducting and defending the project are available in the *DNP Student Handbook*.

Student Handbooks

The policies and procedures guiding the program, progression, and expectations can be found in the *Graduate Student* and *DNP Student Handbooks*. Clinical concentrations may have additional handbooks related to clinical performance and expectations.

Time Limits for Degree Completion

All graduation requirements must be completed within 6 years after enrollment in the first course.

Transfer Credit

DNP students may transfer up to 6 graduate credit hours (with a grade of B or above) with approval of the DNP Graduate Program Director. No course being transferred may be older than 6 years at the time of graduation.

Master of Science in Nursing (MSN)

The Commission on Collegiate Nursing Education (CCNE) accredited Master of Science in Nursing degree is designed to prepare nurses for advanced practice in Nurse Anesthesia Across the Lifespan, Advanced Clinical Nursing, or Systems/Populations Nursing. Active concentrations in Advanced Clinical Practice include Family Nurse Practitioner Across the Lifespan and Adult-Gerontology Acute Care Nurse Practitioner. Inactive concentrations include Psychiatric Mental Health Nursing. Concentrations in Systems/Population include Community/Public Health Nursing; Nurse Administrator; and Nurse Educator. Three post-master's certificates are available: Nurse Anesthesia Across the Lifespan, Adult-Gerontology Acute Care Nurse Practitioner, and Family Nurse Practitioner Across the Lifespan. Two graduate certificates are available: Nurse Administrator and Nurse Educator. Offerings of specific concentrations are dependent on sufficient enrollment. Each concentration is individually described.

Graduates of the program will be eligible to take the American Nurses Credentialing Center (ANCC) advanced examination for relevant specialties and/or other professional certification exams. Graduates completing the Nurse Anesthesia program will be eligible to take the American Association of Nurse Anesthetist Certification exam.

Concentrations

- Nurse Anesthesia Concentration(s)
  - Nurse Anesthesia Across the Lifespan

- Advanced Clinical Nursing Concentration(s)
  - Adult-Gerontology Acute Care Nurse Practitioner
  - Adult Psychiatric Mental Health Nursing *(inactive; not currently being offered)*
  - Family Nurse Practitioner Across the Lifespan

- Systems/Population Nursing Concentration(s)
  - Nurse Administrator
  - Community/Public Health Nursing
  - Nurse Educator

Admission and Progression Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Nursing ***(see additional requirements for specific concentration)***.

1) Current unrestricted licensure as a Registered Nurse; current license in North Carolina or a compact state or the state identified by faculty for clinical practice before enrollment
2) Baccalaureate degree from a college or university accredited by an accepted accrediting body. If the degree is not in Nursing and courses in Research, Leadership/Management, Aging and Health and Community Health are lacking, they will be required as part of the program of study (option available only to Nurse Administration, Community/Public Health Nursing, and Nurse Educator concentrations).
3) Satisfactory performance on the Graduate Record Examination or the Miller Analogies Test or a previous Graduate degree with documentation of test scores
4) One year of professional nursing practice is recommended
5) An essay (statement of purpose) describing the applicant's experience and objective in undertaking graduate study in the chosen concentration
6) Overall GPA of at least 3.0 in the last degree earned
7) Completion of a statistics course with a grade of C or above
8) See concentration admission requirements for application dates that vary from those published by the Graduate School

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree (Advanced Clinical Nursing and Systems/Populations Nursing only) before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The MSN degree requires completions of 36 to 67 graduate credit hours, depending on the concentration. All concentrations require a Capstone Project. Specific requirements and prerequisites for each specialty are listed below. Nurse Practitioner and Nurse Anesthesia are designed to accommodate full-time study. Part-time study is available for some concentrations. Many classes are held in the late afternoon or evening.

Up to a total of six graduate credit hours may be accepted from another college or university accredited by an accepted accrediting body or from a post-baccalaureate program at UNC Charlotte. All courses must be approved prior to transfer by the student's advisor, the Associate Director of the Graduate Division, and the Dean of the Graduate School. All coursework, including accepted transfer credits, must be completed within a six-year period prior to graduation.

Assistantships

A limited number of graduate assistantships are available. Information is available in the School of Nursing, and from the Associate Dean for Academic Affairs, College of Health and Human Services.

Additional Financial Aid

Scholarships from the North Carolina Nurse Scholars Program – Master's Program (M-NSP) are available to part-time or full-time students admitted to the nursing program for up to two years of study. The M-NSP scholarships are competitive and preference will be given to full-time students. Awards are not based on financial need. The application deadline is early May. Further information and application forms are available on the School of Nursing webpage for Student Resources or in the College of Health and Human Services Advising Center.

A limited number of Professional Nurse Traineeships are available to full-time nurse practitioner students. The traineeship awards fund a portion of tuition and fees. Students in the Nurse Anesthesia concentration are eligible for Nurse Anesthesia Traineeships. Further information and application forms are available from the School of Nursing.

Nurse Anesthesia

Master of Science in Nursing (MSN) – Nurse Anesthesia Across the Lifespan

This degree program is not accepting new applicants.*

The Nurse Anesthesia Across the Lifespan concentration is offered in conjunction with Carolinas Medical Center, and is also accredited by the Council on Accreditation of Nurse Anesthesia Education Programs (COA). It provides both the theory and clinical practice required to qualify to take the national certifying examination upon graduation. The program consists of 67 credit hours and can be completed in 27 months of full-time study. In addition to MSN core courses, students complete cognate and clinical courses in nurse anesthesia. Clinical experiences are offered at Carolinas Medical Center and other affiliated sites.

Admission Requirements

In addition to the requirements of the Graduate School and College, applicants to the Nurse Anesthesia Across the Lifespan program must have:

1) Baccalaureate degree in nursing (BSN) from a nursing program from a college or university accredited by an accepted accrediting body
2) A grade point average (GPA) of 3.0 on a 4.0 scale for all undergraduate work after high school
3) A grade point average of 3.0 on a 4.0 scale for all basic undergraduate science courses (Chemistry, Biology, Anatomy and Physiology, Pathophysiology, and Microbiology).
4) Satisfactory performance on the Graduate Record Exam (GRE); a score of 293 on the revised GRE or 950 on the old GRE is preferred (MAT scores are not accepted).
5) A minimum of 18 months of current full time critical care experience with adult clients prior to matriculation.
    a) Acceptable experience includes: Intensive Care Unit, Coronary Care Unit, Trauma Intensive Care Unit, Neuro Intensive Care Unit, Surgical Intensive Care Unit, Cardio-vascular Intensive Care Unit.
    b) Experiences not acceptable include: Flight Team, Emergency Room, Pediatric Intensive Care Unit, Neonatal Intensive Care Unit, and Post Anesthesia Care Unit.
6) Current certification in Basic Cardiac Life Support, Advanced Cardiac Life Support, and Pediatric Life Support with documentation provided only to Carolinas Medical Center Nurse Anesthesia Clinical Program.
7) Statement of Purpose in application packet describing the applicant's experience and objective in undertaking certificate study. Limited to a single page.
8) Applicants who meet the academic admission requirements will be eligible to be invited for an interview with the Clinical Program Admissions Committee.
    a) Interviews are conducted twice a year: November and February.
    b) All application materials must be submitted to the Graduate School and the Nurse Anesthesia program no later than six weeks prior to the interviews. For November interviews, the deadline is September 15; for February interviews, the deadline is January 15.

Application Process

The application process requires two applications – one to UNC Charlotte and one to Carolinas Medical Center. Only after a successful interview will the applicant be admitted.

1) The UNC Charlotte application is completed online and information can be obtained from:

Graduate Admissions
UNC Charlotte
210 Cato Hall
9201 University City Blvd.
Charlotte, NC 28223-0001
704-687-5503 (phone)
704-687-7254 (fax)
graduateschool.charlotte.edu

2) The Carolinas Medical Center application forms and materials can be obtained from:

Carolinas Medical Center
Nurse Anesthesia Program
P.O. Box 32861
Charlotte, NC 28232-2861
704-355-2375 (Phone)
704-355-7263 (Fax)
atriumhealth.org/education/graduate-medical-education/school-of-nurse-anesthesia

Degree Requirements

The program requires completion of 67 credit hours in approved courses as listed below and a capstone which is met with residency IV.

Core Courses (19 credit hours)
NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
NURS 6160 - Research in Nursing and the Health Professions (3)
NURS 6230 - Advanced Health Assessment and Diagnostic Reasoning for Advanced Practice (3)
NURS 6430 - Advanced Health Assessment and Diagnostic Reasoning Practicum (1)
STAT 6127 - Introduction to Biostatistics (3)
BIOL 6273 - Advanced Human Physiology (3)

Concentration Courses (48 credit hours)
NUAN 6151 - Principles of Nurse Anesthesia I (3)
NUAN 6152 - Principles of Nurse Anesthesia II (3)
NUAN 6153 - Principles of Nurse Anesthesia III (3)
NUAN 6154 - Advanced Pharmacology of Non-Anesthetic - Agents (4)
NUAN 6155 - Advanced Pharmacology of Anesthetic Agents (4)
NUAN 6156 - Applied Physics and Chemistry in Nurse Anesthesia (3)
NUAN 6157 - Advanced Applied Pathophysiology in Nurse Anesthesia I (3)
NUAN 6158 - Advanced Applied Pathophysiology in Nurse Anesthesia II (3)
NUAN 6171 - Professional Aspects of Nurse Anesthesia I (1)
NUAN 6172 - Professional Aspects of Nurse Anesthesia II (1)
NUAN 6485 - Clinical Residency in Nurse Anesthesia I (5)
NUAN 6486 - Clinical Residency in Nurse Anesthesia II (5)
NUAN 6487 - Clinical Residency in Nurse Anesthesia III (5)
NUAN 6489 - Clinical Residency in Nurse Anesthesia IV (5)

Degree Total = 67 Credit Hours

Advanced Clinical Specialties

Master of Science in Nursing (MSN) – Adult-Gerontology Acute Care Nurse Practitioner (AGACNP)

These advanced practice registered nurses are prepared to function as Adult-Gerontology Acute Care Nurse Practitioners (AGACNP). Adult-Gerontology Acute Care Nurse Practitioners provide evidence-based care to acutely ill adults with urgent and emergent complex health issues and critically ill adults with life threatening, rapidly changing physiological and pathophysiological conditions. Graduates with this concentration are eligible to take the American Nurses Credentialing Center (ANCC) examination for Adult-Gerontology Acute Care Nurse Practitioners. The AGACNP program is a full-time, campus-based program.

Admission Requirements

- Unencumbered license as a Registered Nurse in North Carolina
- BSN degree from a college or university accredited by an accepted accrediting body; the RN-to-MSN option is not available to NP applicants
- Minimum of 12 months full-time nursing practice in acute care (ICU preferred) at the time of application
- Overall GPA of 3.0 on a 4.0 scale in the last degree earned
- Completion of an undergraduate statistics course with a grade of C or above
- Statement of Purpose explaining the applicant's career goal and preparation in relation to acute care nurse practitioner role and qualities making them a strong applicant (see the School of Nursing website at nursing.charlotte.edu for required elements of the Statement of Purpose) (Note: Statement of Purpose should not exceed two double-spaced typed pages.)
- References should be from professional colleagues and should speak to clinical knowledge and expertise and one's ability to function as a member of the healthcare team; at least one reference from a supervisory person is preferred
- ACLS certification required
- GRE is not required
- Interview may be required

Application is competitive. Students are admitted annually in the Fall semester. See the School of Nursing website at nursing.charlotte.edu for application deadline.

Degree Requirements

The program requires completion of 47 credit hours in approved courses including:

Core Courses (9 credit hours)
NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)

Cognate Courses (6 credit hours)
NURS 6274 - Advanced Human Pathophysiology (3)
STAT 6127 - Introduction to Biostatistics (3)

Advanced Clinical Core (9 credit hours)
NURS 6210 - Family Health in Advanced Practice Nursing (2)
NURS 6220 - Pharmacotherapeutics in Advanced Nursing Practice (3)
NURS 6230 - Advanced Health Assessment and Diagnostic Reasoning for Advanced Practice (3)

NURS 6430 - Advanced Health Assessment Practicum (1)*

Concentration Courses (20 credit hours)
NUNP 6202 - Complex Healthcare Management of Adults (3)
NUNP 6203 - Advanced Care of Critically Ill Adults (3)
NUNP 6250 - Advanced Primary Care and Health Promotion of Adults Across the Lifespan (3)
NUNP 6401 - Advanced Care and Health Promotion Adults Practicum (2)*
NUNP 6402 - Advanced Practice Nursing in Complex Care Practicum (4)*
NUNP 6403 - Advanced Care of Critically Ill Adults Practicum (4)*
NUNP 6431 - Advanced Acute Care Skills Lab (1)*

** Clinical Courses require 60 hours practice for each credit hour. Clinical courses may require travel to clinical sites outside Charlotte and Mecklenburg County.*

Capstone Course (3 credit hours)
NURS 6603 Synthesis in Advanced Nursing Practice (3)

Additional Degree Requirements

- A minimum of 600 hours of supervised clinical experience as a Nurse Practitioner student
- Faculty advising

Degree Total = 47 Credit Hours

Grade Requirements

Students must maintain a GPA of 3.0. Additionally, In order to progress in the concentration, a grade of B or above is required in NURS 6220, NURS 6230, NURS 6274, and NURS 6430.

Post-Master's Certificate in Adult-Gerontology Acute Care Nurse Practitioner (AGACNP)

The Post-Master's Certificate consists of concentration courses in advanced practice nursing (minimum 20 graduate credit hours). This certificate program prepares nurses holding master's degrees in nursing to enter advanced practice nursing as an Adult-Gerontology Acute Care Nurse Practitioner. Nurses already certified as Psych NPs, Women's Health or Pediatric NPs are evaluated for possible exclusion of respective concentration courses and practica from their program. The recipients of this certificate are eligible to take the American Nurses Credentialing Center (ANCC) or American Academy of Nurse Practitioners (AANP) examination for Adult-Gerontology Acute Care Nurse Practitioners. Coursework must be completed within four years. The AGACNP program is a full-time, campus-based program.

Admission Requirements

1) A master's degree in nursing from a college or university accredited by an accepted accrediting body
2) Unencumbered North Carolina License as a Registered Nurse
3) Minimum overall GPA of 3.0 in MSN degree
4) Statement of Purpose explaining the applicant's career goal and preparation in relation to acute care nurse practitioner role, and qualities making them a strong applicant (See School of Nursing website for required elements of the Statement of Purpose). *(Note: Statement of Purpose should not exceed two double-spaced typed pages.)*
5) References should be from professional colleagues and should speak to clinical knowledge and expertise and one's ability to function as a member of the healthcare team. At least one reference from a supervisory person is preferred.
6) Graduate Health Assessment course equivalent within the last 5 years**
7) Graduate Pharmacology course equivalent within the last 5 years**
8) Graduate Pathophysiology within the last 5 years**

***Nurses certified as Adult or Family, Psych, or Pediatric nurse practitioners may have these courses waived from the admission requirements after assessment of transcripts. Nurses with other backgrounds will be evaluated on an individual basis.*

Application is competitive. Students are admitted annually in the Fall semester. See the School of Nursing website at nursing.charlotte.edu for application deadline. Plan of Study is individualized based on course availability.

Certificate Requirements

NUNP 6202 Complex Healthcare management of Adults (3)
NUNP 6203 Advanced Care of Critically Ill Adults (3)
NUNP 6250 Advanced Primary Care and Health Promotion of Adults Across the Lifespan (3)
NUNP 6401 Advanced Care and Health Promotion Adults Practicum (2)***
NUNP 6402 Advanced Practice Nursing in Complex Care Practicum (4)***
NUNP 6403 Advanced Care of Critically Ill Adults Practicum (4)***
NUNP 6431 Advanced Acute Care Skills Lab (1)***

Note: Nurses with other backgrounds will be evaluated on an individual basis.

**** Clinical Courses require 60 hours practice for each 1 credit hour. Clinical courses may require travel to clinical sites outside Charlotte and Mecklenburg County.*

Certificate Total = 20 Credit Hours

Grade Requirements
A minimum GPA of 3.0 is required.

Master of Science in Nursing (MSN) – Family Nurse Practitioner Across the Lifespan

This concentration leads to a MSN with a concentration in Family Nurse Practitioner Across the Lifespan. These Advanced Practice Registered Nurses (APRN) are prepared to function as Nurse Practitioners providing primary care to families across the lifespan. The graduates of this program are eligible to take the American Nurses Credentialing Center (ANCC) or American Academy of Nurse Practitioners (AANP) examination for Nurse Practitioner Across the Lifespan certification. The Family Nurse Practitioner program is a full-time, campus-based program.

Admission Requirements
1) Unencumbered license as a Registered Nurse in North Carolina
2) BSN degree a college or university accredited by an accepted accrediting body; the RN-to-MSN option is not available to NP applicants
3) One year of professional nursing practice
4) Overall GPA of 3.0 on a 4.0 scale in the last degree earned
5) Completion of an undergraduate statistics course with a grade of C or above
6) Statement of Purpose explaining the applicant's career goal and preparation in relation to primary care and family practice, and qualities making them a strong applicant (see nursing.charlotte.edu for required elements of the Statement of Purpose). *(Note: Statement of Purpose should not exceed two double-spaced typed pages.)*
7) References should be from professional colleagues and should speak to clinical knowledge and expertise and one's ability to function a member of the healthcare team. At least one reference from a supervisory person is preferred.
8) GRE is not required

Application is competitive. Students are admitted annually in the Fall semester. See the School of Nursing website at nursing.charlotte.edu for application deadline.

Degree Requirements

Core Courses (9 credit hours)
NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)

Cognate Courses (6 credit hours)
NURS 6274 - Advanced Human Pathophysiology (3)
STAT 6127 - Introduction to Biostatistics (3)

Advanced Clinical Core (7 credit hours)
NURS 6220 - Pharmacotherapeutics in Advanced Nursing Practice (3)
NURS 6230 - Advanced Health Assessment and Diagnostic Reasoning for Advanced Practice (3)
NURS 6430 - Advanced Health Assessment Practicum (1)*

Concentration Courses (21 credit hours)
NUNP 6240 - Advanced Primary Care Reproductive Health (3)
NUNP 6250 - Advanced Primary Care and Health Promotion of Adults Across the Lifespan (3)
NUNP 6260 - Advanced Primary Care of Children and Adolescents (3)
NUNP 6400 - Internship in Family Health Nursing (4)*
NUNP 6440 - Advanced Primary Care Reproductive Health Practicum (2)*
NUNP 6450 - Advanced Primary Care and Health Promotion of Adults Practicum (2)*
NUNP 6460 - Advanced Primary Care of Children and Adolescents Practicum (2)*
NURS 6210 - Family Health In Advanced Practice Nursing (2)

** Clinical Courses require 60 hours practice for each 1 credit hour. Clinical courses may require travel to clinical sites outside Charlotte and Mecklenburg County.*

Capstone Course (3 credit hours)
NURS 6603 - Synthesis in Advanced Nursing Practice (1)

Additional Requirements
- A minimum of 600 hours of supervised clinical experience as a Nurse Practitioner
- Faculty advising

Degree Total = 46 Credit Hours

Grade Requirements
Students must maintain a GPA of 3.0. Additionally, in order to progress in the concentration, a grade of B or above is required in NURS 6220, NURS 6230, NURS 6274, NURS 6430, and all required NUNP courses.

Post-Master's Certificate in Family Nurse Practitioner Across the Lifespan

The certificate consists of concentration courses in advanced practice nursing (minimum 21 credit hours). This certificate program prepares nurses holding master's degrees in nursing to enter advanced practice nursing in primary care as a Family Nurse Practitioner. Nurses already certified as Psych NPs, Women's Health or Pediatric NPs are evaluated for possible exclusion of respective concentration courses and practica from their program. The recipients of this certificate are eligible to take the American Nurses Credentialing Center (ANCC) or the American Academy of Nurse Practitioner (AANP) examination for Family Nurse Practitioner Across the Lifespan certification. Coursework must be completed within five years. The Family Nurse Practitioner program is a full-time, campus-based program.

Admission Requirements

1) A master's degree in nursing from a college or university accredited by an accepted accrediting body
2) Unencumbered North Carolina License as a Registered Nurse
3) Overall GPA of 3.0 on a 4.0 scale in the MSN degree
4) Statement of Purpose explaining the applicant's career goal and preparation in relation to primary care and family practice, and qualities making them a strong applicant (See School of Nursing website for required elements of the Purpose Statement). *(Note: Statement of Purpose should not exceed two double-spaced typed pages.)*
5) References should be from professional colleagues and should speak to clinical knowledge and expertise and one's ability to function as a member of the healthcare team. At least one reference from a supervisory person is preferred.
6) Applicants who meet admission requirements will be eligible to be invited for an interview with the nurse practitioner sub-committee.
7) Graduate Health Assessment course equivalent within the last 5 years**
8) Graduate Pharmacology course equivalent within the last 5 years**
9) Graduate Pathophysiology within the last 5 years**

Application is competitive. Students are admitted annually in the Fall semester. See the School of Nursing website at nursing.charlotte.edu for application deadline.

***Nurses certified as adult nurse practitioners, women's health nurse practitioners, or pediatric nurse practitioners may have these courses waived from the admission requirements after assessment of transcripts. Nurses with other backgrounds will be evaluated on an individual basis.*

Certificate Requirements

NUNP 6240 - Advanced Primary Care Reproductive Healthcare (3)***
NUNP 6250 - Advanced Primary Care and Health Promotion of Adults Across the Lifespan (3)**
NUNP 6260 - Advanced Primary Care of Children and Adolescents (3)****
NUNP 6400 - Internship in Family Health Nursing (4)
NUNP 6440 - Advanced Primary Care Reproductive Healthcare Practicum (2)***
NUNP 6450 - Advanced Primary Care and Health Promotion of Adults Practicum (2)**
NUNP 6460 - Advanced Primary Care of Children and Adolescents Practicum (2)****
NURS 6210 - Family Health in Advanced Practice Nursing (2)

**Clinical Course that requires 60 hours practice for each 1 credit hour. Clinical courses may require travel to clinical sites outside Charlotte and Mecklenburg County.*
***Nurses certified as Adult nurse practitioners will not be required to take these courses.*
****Nurses certified as Women's Health nurse practitioners will not be required to take these courses.*
*****Nurses certified as Pediatric nurse practitioners will not be required to take these courses.*

Certificate Total = 21 Credit Hours

Grade Requirements

A minimum GPA of 3.0 is required.

Master of Science in Nursing (MSN) – Adult Psychiatric Mental Health

*****This degree program is inactive and not currently being offered.*****

The Adult Psychiatric Mental Health Clinical Nurse Specialist concentration focuses on the role of the advanced practice PMHN in the assessment and management of individuals, groups, and communities. Graduates of this program are prepared to complete requirements for certification as a Clinical Specialist in Adult Psychiatric and Mental Health Nursing.

Admission Requirements

1) A Graduate Record Exam (GRE) (score of 500 on

each of 2 of the 3 sections) or the Miller Analogy (MAT) (score of 400 or above) is required
2) Rolling admissions: applicants may apply any time
3) A GPA of at least 3.0 on the last 60 credit hours
4) Computer competency

Degree Requirements

Core Courses (15 credit hours)

NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6210 - Family Health in Advanced Practice Nursing (2)

Cognate Courses (6 credit hours)

STAT 6127 - Introduction to Biostatistics (3)
BIOL 6273 - Advanced Human Physiology (3)

Concentration Courses (22 credit hours)

NURS 6220 - Pharmacotherapeutics for Advanced Nursing Practice (3)
NURS 6230 - Advanced Health Assessment and Diagnostic Reasoning (2)
NURS 6430 - Advanced Health Assessment Practicum (1)
NUMH 6200 - Psychiatric Mental Health Theories and Constructs of Mental Healthcare (3)
NUMH 6130 - Advanced Psychiatric Mental Health Nursing Practice with Individuals (2)
NUMH 6430 - Practicum in Advanced Practice Psychiatric Mental Health Nursing with Individuals (2)
NUMH 6135 - Advanced Psychiatric Mental Health Nursing Practice with Groups and Communities (2)
NUMH 6435 - Practicum in Advanced Practice Psychiatric Mental Health Nursing with Groups and Communities (2)
NUMH 6201 - Seminars in Advanced Practice Psychiatric Mental Health Nursing (1)
NUMH 6401 - Internship in Advanced Psychiatric Mental Health Nursing Practice (4)

Additional Requirements

1) A total of 540 hours of supervised clinical practice experience is required to complete the program
2) Faculty advising is required each semester

Degree Total = 43 Credit Hours

Systems/Populations Specialties

Graduate Certificate in Applied Nursing Informatics

This is a Distance Education program.

The Graduate Certificate in Applied Nursing Informatics is designed for nurses who hold a BSN or graduate nursing degree and desire to enhance their skills in clinical application of nursing informatics. The course content is focused on implementing, managing, or conducting analytics using clinical/administrative information systems. The certificate program consists of four courses (12 credit hours) that can be taken over a calendar year. The courses toward the certificate can be taken concurrently with Nurse Administration and other M.S.N. curriculum. The certificate program is offered online.

Admission Requirements

- B.S.N. or M.S.N. with a minimum GPA of 2.8 from a college or university accredited by an accepted accredited body
- Current unrestricted Registered Nurse license in NC or compact state
- Statement of Purpose that includes a description of the applicant's interest in nursing informatics and career plans using the certification; the statement is not exceed one page in length
- Three letters of professional recommendation

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Certificate Requirements

Required Courses (12 credit hours)

HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6380 - Introduction to Health Informatics (3)
NURS 6187 - Financial, Human, and Information Technology Resource Management in Complex Systems (3)
NURS 6188 - Application of Nursing Informatics in Strategic Planning and Decision-Making (3)

Other Requirements

- Completion of 12 credit hours of required coursework within five years
- This is an online program; access to a computer and reliable internet is required

Certificate Total = 12 Credit Hours

Grade Requirements
Students must maintain a minimum 3.0 GPA in their graduate courses and may not accumulate more than two C grades.

Master of Science in Nursing (MSN) – Nurse Administration

This is a Distance Education program.

This concentration prepares nurses for advanced practice in administrative roles such as Nurse Executive, Nurse Manager, Quality Improvement Manager, Ambulatory Care Manager or other system level nursing positions in community agencies, healthcare facilities, health departments and schools of nursing.

Admission Requirements
1) Current unrestricted licensure as a Registered Nurse; current license in North Carolina or a compact state or the state identified by faculty for clinical practice before enrollment
2) Baccalaureate degree from a college or university accredited by an accepted accrediting body. If the degree is not in Nursing and courses in Research, Leadership/Management, Aging and Health and Community Health are lacking, they will be required as part of the program of study (option available only to Nurse Administration, Community/Public Health Nursing, and Nurse Educator concentrations).
3) One year of professional nursing practice is recommended
4) An essay (statement of purpose) describing the applicant's experience and objective in undertaking graduate study in the chosen concentration, including the qualities making them a strong applicant (See the School of Nursing website for required elements of the Purpose Statement)
5) Overall GPA of at least 3.0 in the last degree earned
6) Completion of a statistics course with a grade of C or above
7) See School of Nursing website for admission deadlines

Degree Requirements
Core Courses (9 credit hours)
NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)

System Core Courses (6 credit hours)
NURS 6211 - Health Disparities and Nursing (3)
or NURS 6090 - Selected Topics (Study Abroad) (3)
NURS 6212 - Program Improvement and Evaluation (3)

Concentration Courses (18 credit hours)
NURS 6185 - Theory and Application in the Organizational Behavior to Nursing Systems (3)
NURS 6187 - Financial, Human, and Information Technology Resource Management in Complex Systems (3)
NURS 6188 - Application of Nursing Informatics in Strategic Planning and Decision-Making (3)
NURS 6282 - Interprofessional Collaboration in Healthcare (3)
or NURS 6302 - Trends and Issues in Nursing Education (3)
or NURS 6303 - Instructional Technology in Nursing Education (3)
NURS 6301 - Curriculum Planning and Instruction (3)
NURS 6485 - Advanced Practicum in Nursing Administration and Leadership (3)

Capstone Course (3 credit hours)
NURS 6603 - Synthesis in Advanced Nursing Practice (3)

Additional Requirements
1) Nursing Administration concentration courses are only offered online through Distance Education; Core and System/Population Core courses can be taken on campus or online as published in the Schedule of Courses
2) Courses in the Nursing Administration concentration are offered every other year
3) A total of 180 clinical hours is required to complete the program
4) Faculty Advising is required
5) Access to computer within minimum requirements for online courses; current minimum computer hardware specifications are listed by Distance Education online at distanceed.charlotte.edu

Degree Total = 36 Credit Hours

Grade Requirements
Students must maintain a minimum 3.0 GPA in their graduate courses, and may not accumulate more than two C grades.

Graduate Certificate in Nurse Administration

This is a Distance Education program.

The Certificate in Nursing Administration is designed for nurses who hold a bachelor's degree and desire to enhance their administrative skills and advanced practice

nurses with master's degree who desire additional knowledge to be competitive in managing personnel or groups.

The Nursing Administration certificate program of study consists of concentration courses in nursing administration (12 graduate credit hours). Students complete four specialty courses. The certificate can be completed in one year through part-time study.

Admission Requirements

1) Baccalaureate degree from a college or university accredited by an accepted accrediting body
2) Graduation from a post-secondary level Nursing Program (United States RN Registration not required)
3) An essay (statement of purpose) in application packet that includes a description of a selected area of specialization in nursing practice
4) Three letters of professional recommendation
5) GRE or MAT is not required for certificate program

Certificate Requirements

Required Courses (12 credit hours)

NURS 6185 - Theory and Application in the Organizational Behavior to Nursing Systems (3)
NURS 6187 - Financial, Human, and Information Technology Resource Management in Complex Systems (3)
NURS 6188 - Application of Nursing Informatics in Strategic Planning and Decision-Making (3)
NURS 6212 - Program Improvement and Evaluation (3)

Additional Requirements

- Completion of 12 credit hours of required coursework within five years
- Access to a computer with minimum requirements for online courses; current minimum computer hardware specifications are listed by Distance Education online at distanceed.charlotte.edu

Certificate Total = 12 Credit Hours

Grade Requirements

Students must maintain a minimum 3.0 GPA in their graduate courses and may not accumulate more than two C grades.

Master of Science in Nursing (MSN) – Nurse Educator

This is a Distance Education program.

This concentration focuses on preparing nurses for advanced roles as a Nurse Educator. Graduates are prepared for positions teaching nursing in college, university, and clinical settings. Two clinical practicum courses totaling 360 supervised hours are required.

Admission Requirements

1) Current unrestricted licensure as a Registered Nurse in North Carolina or a compact state or the state identified by faculty for clinical practice before enrollment
2) Baccalaureate degree from a college or university accredited by an accepted accrediting body; if the degree is not in Nursing and courses in Research, Leadership/Management, Aging and Health and Community Health are lacking, they will be required as part of the program of study (option available only to Nurse Administration, Community/Public Health Nursing, and Nurse Educator concentrations)
3) One year of professional nursing practice is recommended
4) An essay (statement of purpose) describing the applicant's experience and objective in undertaking graduate study in the chosen concentration, including the qualities making them a strong applicant (See the School of Nursing website for required elements of the Purpose Statement).
5) Overall GPA of at least 3.0 in the last degree earned
6) Completion of a statistics course with a grade of C or above
7) See School of Nursing website for admission deadlines

Degree Requirements

This program requires completion of 39 credit hours in approved courses, including two clinical practicum and a synthesis course.

Core Courses (12 credit hours)

NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
STAT 6127 - Introduction to Biostatistics (3)

Concentration Courses (24 credit hours)

NURS 6212 - Program Improvement and Evaluation (3)
NURS 6301 - Curriculum and Instruction in Nursing Education (3)
NURS 6302 - Trends and Issues in Nursing Education (3)
NURS 6303 - Instructional Technology in Nursing Education (3)
NURS 6305 - Advanced Pathology and Pharmacology for Nurse Educators (3)
NURS 6304 - Teaching Practicum in Nursing Education (3)
NURS 6306 - Health Assessment for Nurse Educators (3)
NURS 6495 - Nurse Educator Advanced Clinical Practicum (3)

Capstone Course (3 credit hours)
NURS 6603 Synthesis in Advanced Nursing Practice (3)

Additional Requirements

- A total of 180 hours in a clinical specialty and 180 hours of supervised teaching experience is required. The clinical site and preceptors are individually arranged by students and course faculty. CAUTION: Not all states allow out-of-state programs to oversee clinical rotations in their state. Check with faculty advisors before taking travel assignments or relocating to other states.
- Faculty Advising is required.
- This is a Distance Education program, dependable access to computer and the internet are required. Current minimum computer hardware specifications are listed online by Distance Education at distanceed.charlotte.edu.

Degree Total = 39 Credit Hours

Graduate Certificate – Nurse Educator

This is a Distance Education program.*

The Graduate Certificate in Nursing Education is designed to prepare nurses who have a BSN or MSN to become educational leaders in academic and clinical settings. This certificate consists of four courses, for a total of 12 credit hours and can be completed within one calendar year. The Graduate Certificate provides students with the coursework needed to enhance the student's professional teaching skills.

Admission Requirements

1) BSN or Master of Science in Nursing (MSN) degree from a college or university accredited by an accepted accrediting body
2) Current unrestricted licensure as a Registered Nurse
3) An essay (statement of purpose) in application packet that includes a description of a selected area of specialization in nursing practice. It is expected that the student will develop a portfolio demonstrating expertise in a specialization during this program of study.
4) Three letters of professional recommendation
5) GRE or MAT is not required for certificate program

Certificate Requirements

Required Courses (12 credit hours)
NURS 6301 - Curriculum and Instruction in Nursing Education -
NURS 6302 - Trends and Issues in Nursing Education
NURS 6303 - Instructional Technology in Nursing Education
NURS 6304 - Teaching Practicum in Nursing Education

Additional Requirements

1) A total of 180 hours of supervised teaching experience, individually arranged, is required
2) Access to computer within minimum requirements for online courses. Current minimum computer hardware specifications are listed by Distance Education online at distanceed.charlotte.edu.

Certificate Total = 12 Credit Hours

Master of Science in Nursing (MSN) – Community/Public Health Nursing

This is a Distance Education program.*

The Community/Public Health Nursing concentration prepares nurses to assume leadership in assessing communities and populations, identifying high risk groups, and in partnership with communities, consumers, and stakeholders, developing culturally sensitive, acceptable and realistic community-based nursing services.

Admission Requirements

1) Current unrestricted licensure as a Registered Nurse; current license in North Carolina or a compact state or the state identified by faculty for clinical practice before enrollment
2) Baccalaureate degree in Nursing from a college or university accredited by an accepted accrediting body. If the degree is not in Nursing and courses in Research, Leadership/Management, Aging and Health and Community Health are lacking, additional coursework in these areas will be required as part of the program of study (option available only to Nurse Administration, Community/Public Health Nursing, and Nurse Educator concentrations)
3) One year of professional nursing practice is recommended
4) An essay (statement of purpose) describing the applicant's experience and objective in undertaking graduate study in the chosen concentration, including the qualities making them a strong applicant (See the School of Nursing website for required elements of the Purpose Statement)
5) Overall GPA of at least 3.0 in the last degree earned
6) Completion of a statistics course with a grade of C or above
7) See School of Nursing website for admission deadlines

Degree Requirements

Core Courses (9 credit hours)
NURS 6101 - Theoretical Basis for Nursing Practice (3)
NURS 6160 - Research in Nursing and Health Professions (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)

Cognate Courses (6 credit hours)
NURS 6202 - Applied Epidemiology in Advanced Nursing (3)
STAT 6127 - Introduction to Biostatistics (3)

Elective Course (3 credit hours)
Select one of the following:
NURS 6185 - Theory and Application in the Organizational Behavior to Nursing Systems (3)
NURS 6187 - Financial, Human, and Information Technology Resource Management in Complex Systems (3)
NURS 6188 - Application of Nursing Informatics in Strategic Planning and Decision-Making (3)
NURS 6275 - Health Promotion, Nutrition, and Wellness for Older Adults (3)
NURS 6301 - Curriculum and Instruction in Nursing Education (3)
NURS 6302 - Trends and Issues in Nursing Education (3)
NURS 6303 - Instructional Technology in Nursing Education (3)
EIST 5100 - Technology Integration in Education (3)
EIST 6000 - Topics in Instructional Systems Technology (16)
EIST 6100 - Foundations of Instructional Systems Technology (3)
EIST 6101 - Learning Principles in Instructional Systems Technology (3)
EIST 6110 - Instructional Design (3)
EIST 6135 - Learning Media, Resources, and Technology (3)

System Core Courses (6 credit hours)
NURS 6211 - Health Disparities and Nursing (3)
or NURS 6090 - Selected Topics *(Study Abroad)*
NURS 6212 - Program Improvement and Evaluation (3)

Concentration Courses (11 credit hours)
NURS 6180 - Community/Public Health Nursing (3)
NURS 6480 - Internship I (3)
NURS 6481 - Internship II (3)
NURS 6210 - Family Health in Advanced Practice Nursing (2)

Capstone Course (3 credit hours)
NURS 6603 - Synthesis in Advanced Nursing Practice (3)

Additional Requirements
This concentration also requires the completion of 360 hours of supervised clinical practicum.

Degree Total = 38 Credit Hours

Grade Requirements
Students must maintain a GPA of 3.0 or above.

PUBLIC HEALTH SCIENCES

- Ph.D. in Public Health Sciences
  - Behavioral Sciences
- Master of Public Health (MPH)
  - Community Health Practice
  - Epidemiology
  - Physical Activity and Nutrition
  - Population Health Analytics
- MPH/M.A. in Anthropology Dual Degree
- MPH/M.S. in Health Informatics and Analytics Dual Degree

Department of Public Health Sciences
publichealth.charlotte.edu

Ph.D. in Public Health Sciences

The focus of the Ph.D. in Public Health Sciences is to train researchers and professionals with skills essential to address contemporary public health problems at the individual, community, and population levels.

Students train to be well-rounded public health professionals: learning how to disseminate research to diverse audiences, publishing in peer-reviewed formats, teaching in an academic environment, and conducting themselves with high ethical standards in all venues. Full-time students can complete the degree requirements within 4 years; however, most full-time students complete the program within 5 years depending upon the design of their dissertation research. Graduates are prepared to work in academia, conduct large-scale public health research projects, or work in government or health-related venues.

Concentration in Behavioral Sciences
The Concentration in Behavioral Sciences emphasizes investigation of health determinants related to the prevention and management of disease and disability among diverse and vulnerable populations in the United States. Working with the community in multidisciplinary teams to understand and develop programs that address the broad social-ecological factors that influence health behavior and thus health outcomes is the primary emphasis of this concentration.

Coursework for the Ph.D. in Public Health Sciences with a

Concentration in Behavioral Sciences has a dual emphasis on qualitative and quantitative methods, and the development, application, and measurement of theory to understand the social and cultural factors that influence health behavior. Graduates are prepared to work in academia, conduct large-scale behavioral research projects, or work in government or health-related venues.

Admission Requirements

All applicants must complete an online application to the Graduate School. Applications must be completed by January 10 for full consideration for the following Fall semester, or by March 15 for consideration on a space-available basis. The minimum admission requirements for the program are as follows:

- Master's degree in public health or a related field with a minimum GPA of 3.5 (on a 4.0 scale) in all graduate work
- Competitive GRE scores taken within the past 5 years
- TOEFL if the previous degree was from a country where English is not the official language, with a minimum score of 83 (Internet-based test), 220 (computer-based test), or 557 (paper-based test)
- Statement of Purpose in which the applicant discusses the following in one or two single-space pages:
  - Their professional, academic, and community experiences
  - The area of research they wish to potentially pursue as a student in the program, the name of at least one member of the Ph.D. in Public Health Sciences program faculty or affiliate faculty who shares this research interest, and a brief statement regarding how their proposed research area aligns with the research of the identified faculty member(s)
  - Their specific interest in UNC Charlotte's program
  - Their career and personal goals, including how the program aligns with their career plans
  - How they plan to actively participate in UNC Charlotte's mission to advance health equity and well-being in an urbanizing world
- Three letters of recommendation, including at least two letters from former professors familiar with the applicant's graduate work
- Have completed a CEPH (Council on Education for Public Health) accredited Master's degree in public health. Students who have not completed a Master's degree in public health may be required to take additional courses as determined by the Ph.D. Review Committee upon review of current CEPH requirements. Such courses will be specified at the time of admission into the program (see below for Prerequisite Coursework).

Admission Assessment

For fullest consideration of admission and financial awards, applications need to be completed by January 10. This deadline is especially important for applicants who want to be considered for assistantships or for fellowship opportunities. Applications completed after January 10 but by March 15 will be reviewed, and decisions regarding admission made on a space-available basis.

Prerequisite Coursework

Students who graduated with an MPH or MSPH degree from a CEPH accredited program or school are assumed to have met the required prerequisite foundation courses. Students entering with a master's degree in a field other than public health must complete the Required Prerequisite Foundation courses in Public Health in the first year of starting the program in consultation with the Ph.D. Director and/or Advisor. These prerequisite foundation course credits do not count toward the 63 credit hours required for the Ph.D.

Required Prerequisite Foundation Courses in Public Health (9 credit hours)

HLTH 6200 - Case Studies in Public Health (3)
HLTH 6211 - Evidence-Based Methods in Public Health (3)
HLTH 6271 - Public Health Data Analysis (3)

Degree Requirements

This degree program requires 63 post-master's credit hours. All coursework must be taken at the 6000-level or above. The majority of the courses are at the 8000-level.

Core Methods Courses (15 credit hours)

HLTH 8201 - Introduction to Quantitative Research Design (3)
HLTH 8270 - Applied Biostatistics: - Regression (3)
HLTH 8271 - Applied Biostatistics: - Multivariate Methods (3)
HLTH 8281 - Measurement and Scale Development (3)
HLTH 8282 - Health Survey Design and Research (3)

Professional Seminar Courses (9 credit hours)

HLTH 8601 - Ethics and Integrity in Health Research and Practice (3)
HLTH 8602 - Communicating and Disseminating Research (1)
HLTH 8603 - Teaching Portfolio (3)
HSRD 8604 - Seminar in Health Disparities (1)
HSRD 8605 - Seminar in Grant Proposal Writing (1)

Concentration in Behavioral Sciences Courses (12 credit hours)

HLTH 8220 - Theories and Interventions in Behavioral Science (3)
HLTH 8221 - Qualitative Research in Behavioral Sciences (3)
HLTH 8223 - Social Determinants of Health (3)

HSRD 8261 - Healthcare Program Evaluation, Outcomes, and Quality (3)

Specialty Content Courses (9 credit hours)
Specialty content areas are developed in consultation with the doctoral student's advisor and make use of expertise and course offerings on the UNC Charlotte campus. Specialty content areas can focus on a specific population (e.g., older adults/gerontology or maternal and child health (MCH)), a health issue (e.g., AIDS), or approach (e.g., psychology). A specialty content area should cover literature related to: health and social policy issues, epidemiology of a health condition/population, relevant theories or approaches related to the condition/population, and/or current topics in the area. Coursework must be at the 6000-8000 level.

Dissertation Courses (18 credit hours)
HLTH 8901 - Dissertation Research (3, 6, or 9)

Degree Total = 63 Credit Hours

Grade Requirements
Students must maintain a minimum cumulative 3.0 GPA (on a 4.0 scale) in all coursework taken in the program. An accumulation of 2 C grades will result in suspension of enrollment in the doctoral program.

A grade of U or N constitutes an automatic termination of enrollment. Furthermore, a second failure of the comprehensive exam, the dissertation proposal defense, or the final dissertation defense also results in dismissal from the program.

Transfer Credit
The UNC Charlotte Graduate School stipulates that students may transfer up to 30 graduate level credit hours from a college or university accredited by an accepted accrediting body toward a doctoral degree. This Ph.D. program limits master's level transfer credits to at most 6 credit hours. Master's level transfer credits will be considered only toward Specialty Content courses, the Ethics Seminar (HLTH 8601), and the Measurement course (HLTH 8281). The Ph.D. Program Director, in conjunction with Program Faculty, approves graduate level transfer credits. Students must apply for transfer of graduate levels courses within the first year of enrollment, or within one semester following completion of the course if taken during the Ph.D. program. Only courses in which the student earned a grade of B or above (or its equivalent) may be transferred.

Students transferring from another doctoral program can transfer up to 30 credit hours (with not more than 6 at the master's level) upon approval of the Ph.D. Program Director. Credit for dissertation research cannot be transferred.

Courses taken to fulfill the master's level prerequisite public health courses do not count toward the 63 credit hour total.

Assistantships
Exceptionally qualified full-time students may be offered graduate assistantships. Award of the assistantship follows the guidelines of the Graduate School and is dependent on availability of funds.

Comprehensive Exam and Advancing to Candidacy
The comprehensive examination takes place at least once per year. The comprehensive examination consists of three sections: 1) Methods section, 2) Social-behavioral section, and 3) Integrative section. The examination must be taken and passed prior to enrollment in dissertation research credit hours (HLTH 8901). Specific procedures regarding the grading of the comprehensive examination are detailed in the *Public Health Sciences Ph.D. Student Handbook*.

A doctoral student advances to candidacy after the dissertation proposal has been approved by the student's Dissertation Committee and the Graduate School. Candidacy must be achieved at least one term prior to the term of graduation.

Dissertation
The dissertation is an original research project conceived, conducted, analyzed, and interpreted by the student to demonstrate expertise in her/his concentration and chosen specialty area as it relates to public health. The research must make a distinct, original contribution to the field of public health research. Students cannot register for dissertation credits until they have passed their comprehensive examination. Students must complete a minimum of 18 credit hours of dissertation research activity. Per University policy, students must be continuously enrolled in dissertation credit hours beginning with the semester after the dissertation topic proposal is approved, through and including the semester of graduation. Guidelines for selecting a Dissertation Chair and Committee Members are provided in detail in the *Public Health Sciences Ph.D. Student Handbook*. The dissertation consists of three phases: the proposal defense, research, and the final dissertation defense.

In conjunction with the Dissertation Committee, students agree on the dissertation topic and indicate their preferred dissertation format – either the "traditional" 5-chapter model or the 3-manuscript model. The dissertation proposal consists of three chapters: 1) introduction to the problem including the importance of the problem, significance of the proposed research, the research

question and hypotheses; 2) conceptual model and literature review; and 3) a detailed methods section including sampling, recruitment, measures, data analysis, and limitations. With the guidance of the Dissertation Chair, students work with each committee member individually to develop the scope and direction of the dissertation. Students provide the overall idea for the dissertation including major concepts to be investigated, measures to be used, and strategy for primary or secondary data analysis. The dissertation topic proposal must be defended at a meeting of the student's advisory/dissertation committee.

The dissertation defense is scheduled when the Dissertation Chair and the student concur that the student has a final product that meets with initial committee member approval. The outcome of the exam is pass or fail. Details regarding development of the dissertation proposal, proposal defense, conducting the dissertation research, and dissertation defense are available in the *Public Health Sciences Ph.D. Student Handbook*.

Program Progress

Doctoral students and candidates are evaluated annually to ensure that they are making sufficient progress to complete the degree in a timely manner. This evaluation is especially important during the dissertation process when students have less programmatic interaction and structure as they work more independently conducting their dissertation research. Please consult the *Public Health Sciences Ph.D. Student Handbook* for further details.

Time Limits for Completion

Students must pass all sections of the comprehensive exam within one year of finishing their required coursework. Students may not defend their dissertation proposal before passing all components of the comprehensive exam. Students must pass their dissertation proposal defense within 6 months of passing the comprehensive exam. Students must pass their dissertation defense within five years of the proposal defense, but not later than the end of their eighth year following matriculation as a doctoral student. Students must complete their degree, including the dissertation, within nine years of first registering as a doctoral student.

Residency Requirement

Residency requirements for the program include completing 21 hours of continuous enrollment, either as coursework or dissertation credits. Residence is considered to be continuous if the student is enrolled in one or more courses in successive semesters until 21 hours are earned.

Master of Public Health (MPH)

The Master of Public Health (MPH) program prepares graduate students to apply core principles of public health within a variety of community settings and to advance the public health profession. The MPH program seeks to fulfill the Department of Public Health Sciences' vision: "Healthy communities partnered with responsive population health systems." To support the department's mission, "Advancing health equity and well-being in an urbanizing world," the MPH program develops leaders in evidence-based practice who advance the public's health. The program values collaboration, community engagement, diversity, innovation, professionalism, health equity, and social justice in its pursuit of attaining the highest possible standards of health and well-being.

Students develop specialized skills in one of four concentrations:

1) Community Health Practice (CHPR)
2) Epidemiology (EPID)
3) Physical Activity and Nutrition (PANU)
4) Population Health Analytics (PHAN)

The program prepares students to provide leadership in a variety of settings, including health-related agencies and organizations, hospitals, local and state public health departments, academic research centers and institutes, corporate disease management and wellness programs, non-profit agencies, and healthcare businesses and industries.

Program Goals

The MPH program achieves its mission through a set of complementary and reinforcing instructional, practice, service, and diversity goals that reflect the program's values and provide a framework for defining, assessing, and evaluating both students and the curriculum.

- Goal 1 (instructional): We develop leaders to promote health equity
- Goal 2 (research): We engage in scholarship to strengthen the public health evidence base
- Goal 3 (service): We collaborate with partners and stakeholders to advance population well-being

Admission Requirements

1) Recommended GPA of 3.0 or higher out of 4.0
2) Bachelor's degree by time of desired enrollment
3) Three letters of recommendation; at least two letters are preferred from academic professors who have taught the applicant in the classroom and can confirm their written and oral abilities

4) Personal statement describing the applicant's interest in public health, desired concentration, and professional goals

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required. Applicants must address the quantitative, verbal, and analytic abilities within their admissions essay.

For Non-U.S. Students

1) If English is not the applicant's native language and she or he has not earned a post-secondary degree from a U.S. institution, they are required to submit official scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS). Either a minimum score of 557 on the paper-based TOEFL, a minimum score of 83 on the Internet-based TOEFL, or a minimum overall band score of 6.5 on the IELTS is required.
2) Internationally trained physicians who have passed Step 1, Step 2 CK, and Step 2 CS of the U.S. Medical Licensing Exam (USMLE) have the equivalent of a U.S. Medical Degree (MD), can request an exemption from the English language proficiency requirements.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Admission Process

The MPH Program accepts students for both Fall and Spring admission. Applications are reviewed on a rolling basis by the Admissions Committee beginning in October for admission in Fall of the coming year. Offers for assistantships and nominations for scholarships are made for admitted students in early Spring; thus, it is recommended that candidates submit applications by the preferred submission date of January 15 for Fall admission. However, applications may be submitted after the preferred date as well.

Students applying for Spring admission should be advised that because of the budgeting cycle, there are limited opportunities for funding the first semester. Depending upon the concentration chosen, students may need to attend an extra semester based on course sequencing and frequency of course offerings. The preferred application submission date for Spring is November 1.

All admission decisions are typically made within 1 month of the application being completed and submitted.

Degree Requirements

The curriculum leading to the Master of Public Health degree requires a minimum of 45 graduate credit hours. The plan of study includes 15 credit hours of core courses; an applied learning experience (internship; 3 credit hours); a concentration with its core courses (15 credit hours) and its associated integrative learning experience or ILE (3 credit hours); and elective courses (9 credit hours).

While the program can be completed within two academic years (4 semesters plus Summer), 5 semesters is the expected time to completion for full-time students. Part-time students are expected to complete the program within 5 years (10 semesters).

Core Courses (15 credit hours)

HADM 6100 - Intro to the U.S. Healthcare System (3)
HLTH 6200 - Case Studies in Public Health (3)
HLTH 6211 - Evidence-Based Methods in Public Health (3)
HLTH 6212 - Health Promotion Program Management (3)
HLTH 6213 - Policy and Leadership (3)

Applied Learning Experience (3 credit hours)

HLTH 6471 - Public Health Internship (3)

Concentration Courses (18 credit hours)

Select one of the following concentrations, which include an associated 3 credit hour capstone course. The capstone course is an integrative learning experience where students synthesize their foundational and concentration-specific knowledge and skills. Students declare a concentration at the time of application for admission to the MPH. Students desiring to change concentrations should notify their advisor by the end of their second semester. Students must meet any eligibility requirements as outlined in the concentration.

Community Health Practice (CHPR) Concentration

The Community Health Practice concentration is designed to train students to conduct the 3 core functions of public health: assessment, policy development, and evaluation. These activities include measuring health behavior, designing appropriate educational or policy interventions, and implementing and evaluating health promotion, risk prevention and risk reduction services. Students completing the Community Health Practice concentration will be eligible to sit for and pass the Certified Health Education Specialist (CHES) exam.

Eligibility

The Community Health Practice concentration is open to all MPH students.

Required Courses

HLTH 6220 - Applied Health Behavior Change (3)
HLTH 6225 - Health Education and Health Promotion (3)
HLTH 6226 - Community Health Methods (3)

HLTH 6227 - Community Health Planning and Evaluation (3)
HLTH 6228 - Social Determinants of Health (3)
HLTH 6230 - Community Health Practice Capstone (3)

Epidemiology (EPID) Concentration

The MPH Concentration in Epidemiology provides students a broad understanding of epidemiological principles and its application to public health practice. Through coursework, integrated learning experience, and internship, students develop quantitative and methodological skills necessary to design, conduct, analyze, and disseminate epidemiological studies.

Eligibility

It is recommended that students interested in the Concentration in Epidemiology complete HLTH 6211 in their first semester of matriculation with a grade of B or above and maintain an overall GPA of 3.0 at the end of the first semester.

Required Courses

HCIP 6102 - Healthcare Data Analysis (3)
HLTH 6260 - Analytic Epidemiology (3)
HLTH 6270 - Epidemiologic Methods (3)
HLTH 6271 - Public Health Data Analysis (3)
HLTH 6280 - Epidemiology Capstone Course (3)

Elective Course

Select one of the following:

HLTH 6273 - Infectious Disease Epidemiology (3)
HLTH 6274 - Chronic Disease Epidemiology (3)
HLTH 6275 - Reproductive Epidemiology (3)
HLTH 6276 - Environmental and Occupational Epidemiology (3)
HLTH 6277 - Nutritional Assessment and Epidemiology (3)

Physical Activity and Nutrition (PANU) Concentration

The Physical Activity and Nutrition concentration is designed to train students to develop, deliver, and assess population-based, health promotion interventions related to improving physical activity and nutrition. These activities include selecting appropriate behavior assessment tools, designing appropriate educational interventions, and assessing behavioral levels to determine risk.

Eligibility

The Physical Activity and Nutrition concentration is open to all MPH students.

Required Courses

HLTH 6104 - Population Perspectives on Nutrition and Physical Activity (3)
HLTH 6220 - Applied Health Behavior Change (3)
HLTH 6230 - Community Health Practice Capstone (3)
HLTH 6277 - Nutritional Assessment and Epidemiology (3)
KNES 5232 - Physiology of Human Aging (3)
KNES 6110 – Assessment of Physical Activity Across the Lifespan (3)

*Population Health Analytics (PHAN) Concentration**

The Population Health Analytics concentration provides students a thorough grounding in data science, system architecture, and analytics that prepares them to advance population and community health through the practice of health informatics. Emphasis is placed on understanding existing health systems data and the use of analytic techniques applied to large data sets such as visualization and geographic mapping.

Eligibility

By the end of the first semester of matriculation in the program, students must complete (or be excused from based upon prior training and/or experience) non-credit asynchronous training modules in computer vocabularies, programming systems, health vocabularies, and classification systems.

Required Courses

HCIP 5376 - Introduction to Programming for Health Informatics (3)
HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6108 - Decision Analysis in Healthcare (3)
HCIP 6160 - Big Data Design, Storage, and Provenance in Healthcare (3)
HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)
HCIP 6380 - Introduction to Health Informatics (3)

**Notes:*

- *MPH students in this concentration cannot apply these credit hours to both the MPH and the Graduate Certificate in Health Informatics and Analytics*
- *Students in the MPH and M.S. in Health Informatics and Analytics Dual Degree program are prohibited from selecting PHAN as their MPH concentration*

Elective Courses (9 credit hours)

MPH students are required to take 2 elective courses with the HLTH prefix and 1 interprofessional elective course outside the department. MPH students enrolled in a Graduate Certificate program (e.g., Emergency Management, Gerontology, or Health Informatics and Analytics) by the end of their first year, may be eligible to substitute some of their certificate credit hours for their MPH elective credit hours. Please consult the MPH Graduate Program Director for further details.

Cross-Cutting Elective Course (3 credit hours)

Select one of the following:

HLTH 5090 - International Comparative Health Systems (3)
HLTH 6101 - International Health (3)
HLTH 6102 - Environmental Health (3)

HLTH 6103 - Maternal and Child Health Systems (3)
HLTH 6104 - Population Perspectives on Nutrition and Physical Activity (3)
HLTH 6105 - Gender and Sexual Health (3)

Restricted Elective Course (3 credit hours)
Select a second course from the above Cross-Cutting Elective Courses OR one of the following:
HCIP 6380 - Introduction to Health Informatics (3)
HLTH 6000 - Special Topics in Public Health (3)
HLTH 6225 - Health Education and Health Promotion (3)
HLTH 6226 - Community Health Methods (3)
HLTH 6228 - Social Determinants of Health (3)
HLTH 6274 - Chronic Disease Epidemiology (3)
HLTH 6276 - Environmental and Occupational Epidemiology (3)

Interprofessional Elective Course (3 credit hours)
Complete one master's level course from any discipline outside the Department of Public Health Sciences (e.g., Social Work, Gerontology, Psychology). IPEs cannot include any courses with the HLTH, HADM, or HCIP prefix (or any courses cross-listed with those prefixes).

Degree Total = 45 Credit Hours

Advising
Students are assigned an academic advisor during their first semester of the program; advisor assignments are based on the student's declared concentration. Students are expected to meet with their advisors at least once per semester to plan their progression through the program. The Graduate Program Director must approve any course substitutions or transfer credits.

Assistantships
Positions as a graduate assistants or teaching assistants may be available. Research assistantships may be available as well, and are competitively awarded. Assistantships pay a stipend, which may vary. Students seeking assistantships should contact the Graduate Program Director in the Department of Public Health Sciences for additional information or consult the MPH website.

Financial Aid/Financial Assistance
Financial aid and assistance is available to qualifying students, which may be accessed through the Office of Student Financial Aid. See the Financial Information section of this *Catalog* for more information on the opportunities that are available, and how to contact the Office of Student Financial Aid.

Program Certifications/Accreditations
The MPH Program is fully accredited by the Council on Education for Public Health (CEPH). The Department of Public Health Services is a member of the Association of Schools and Programs of Public Health (ASPPH). Students completing the MPH Program are eligible to sit for the Certified in Public Health (CPH) credentialing exam administered by the National Board of Public Health Examiners. Students completing the MPH Community Health Practice concentration are eligible to take the Certified Health Education Specialist (CHES) examination administered by the National Commission for Health Education Credentialing (NCHEC); students completing alternate concentrations also may be eligible to sit for the CHES examination.

MPH/M.A. in Anthropology Dual Degree

This dual degree program combines public health practice and applied anthropological methods for students interested in having a public health anthropology focus. The degree consists of 63 credit hours (80% of the 45 credit hours required for the Master of Public Health [36] and 75% of the 33 credit hours required for the Master of Arts in Anthropology [27]). The time to degree completion is 3 years (6 Fall/Spring semesters plus 1 Summer semester).

For the MPH, students complete the 5 core courses (15 credit hours), the 3 credit hour applied learning experience or internship, and the 18 credit hours associated with either the Community Health Practice or the Epidemiology concentration. For the M.A. in Anthropology, students complete 15 core credit hours with a focus on theory and ethnographic methods and then complete the 18 credit hour practicum option.

Admission Requirements
Interested students must submit a separate application to each program. Each program's admission committee independently reviews applicants with respect to that degree program. Applicants may be offered admission into neither, one, or both programs. Students admitted into both programs may opt for the dual degree program or to matriculate into only the MPH or only the M.A. in Anthropology program. Students already having matriculated into either the MPH or M.A. program who desire to add the dual degree option must apply and gain admission to the other program no later than the end of their first semester of matriculation.

Degree Requirements
Combined Core Courses (30 credit hours)
Required Courses
Take the following required core courses from both Public Health and Anthropology:
ANTH 5122 - Ethnographic Methods (3)
ANTH 6601 - History of Anthropology (3)

ANTH 6602 - Seminar in Interdisciplinary Anthropology (3)
ANTH 6603 - Theory in Social and Cultural Anthropology (3)
HADM 6100 - Introduction to the U.S. Healthcare System (3)
HLTH 6200 - Case Studies in Public Health (3)
HLTH 6211 - Evidence-Based Methods in Public Health (3)
HLTH 6212 - Health Promotion Program Management (3)
HLTH 6213 - Policy and Leadership (3)

Elective Course
Select one additional Anthropology course from the following:
ANTH 6604 - Issues in Archaeological Practice (3)
ANTH 6605 - Evolutionary and Biological Anthropology (3)
ANTH 6606 - Language and Culture: Foundational Issues in Linguistic Anthropology (3)

Public Health Concentration Courses (18 credit hours)
Select one of the following Public Health concentrations and its course requirements:

Community Health Practice
Required Courses
HLTH 6220 - Applied Health Behavior Change (3)
HLTH 6225 - Health Education and Health Promotion (3)
HLTH 6226 - Community Health Methods (3)
HLTH 6227 - Community Health Planning and Evaluation (3)
HLTH 6228 - Social Determinants of Health (3)
HLTH 6230 - Community Health Practice Capstone (3)

Epidemiology
Required Courses
HCIP 6102 - Healthcare Data Analysis (3)
HLTH 6260 - Analytic Epidemiology (3)
HLTH 6270 - Epidemiologic Methods (3)
HLTH 6271 - Public Health Data Analysis (3)
HLTH 6280 - Epidemiology Capstone Course (3)

Elective Course
Select one of the following:
HLTH 6273 - Infectious Disease Epidemiology (3)
HLTH 6274 - Chronic Disease Epidemiology (3)
HLTH 6275 - Reproductive Epidemiology (3)
HLTH 6276 - Environmental and Occupational Epidemiology (3)

Practicum Courses (15 credit hours)
ANTH 6400 - Anthropology Practicum (3)
ANTH 6611 - Seminar in Applied Anthropology (3)
ANTH 6613 - Seminar in Medical Anthropology (3)
ANTH 5xxx-6xxx - Anthropology Elective (3)
HLTH 6471 - Public Health Internship (3)

Other Requirements
Students complete a combined internship and research-based report with an appropriate and approved community-based entity.

Dual Degree Total = 63 Credit Hours

Grade Requirements
Students are required to maintain an overall GPA of 3.0.

MPH/M.S. in Health Informatics and Analytics Dual Degree

The Master of Public Health (MPH) and Professional Science Master's in Health Informatics and Analytics (HIA PSM) dual degree program allows students to earn both an MPH and an M.S. in Health Informatics and Analytics degree. The MPH and HIA PSM dual degree program consists of 63 credit hours of coursework, in contrast to the 81 credit hours required if these degrees were pursued separately.

Admission Requirements
Interested students must submit a separate application to each program. Each programs' admission committee independently reviews applicants with respect to that degree program. Applicants may be offered admission into neither, one, or both programs. Students admitted into both programs may opt for the dual program or to matriculate into only the MPH or HIA PSM program.

Students already having matriculated into either the MPH or HIA PSM program who desire to add the dual degree option must apply and gain admission to the other program no later than the end of their first semester of matriculation.

Degree Requirements
In addition to the requirements outlined below, students must complete – or be excused from, based upon prior training and/or experience – non-credit asynchronous training modules in computer vocabularies, programming systems, health vocabularies, and classification systems by the end of their first semester of matriculation into the dual degree program.

Blended Core Courses (30 credit hours)
HADM 6100 - Introduction to the U.S. Healthcare System (3)
HCIP 5376 - Introduction to Programming for Health Informatics (3)
HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6160 - Big Data Design, Storage, and Provenance in Healthcare (3)
HLTH 6200 - Case Studies in Public Health (3)
HCIP 6201 - Health Information Privacy and Security: Law, Ethics, and Technology (3)
HLTH 6211 - Evidence-Based Methods in Public Health (3)
HLTH 6212 - Health Promotion Program Management (3)
HLTH 6213 - Policy and Leadership (3)
HCIP 6380 - Introduction to Health Informatics (3)

Additional Health Informatics and Analytics Courses (9 credit hours)
HCIP 6108 - Intermediate Decision Analysis in Healthcare (3)
HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)

Plus one of the following:
HCIP 5122 - Visual Analytics (3)
HCIP 6392 - Enterprise Health Information Systems (3)
HCIP 6393 - Health Data Integration (3)
HCIP 6396 - Business Intelligence in Healthcare (3)

MPH Concentration Courses (18 credit hours)
Select one of the following MPH concentrations* and its associated capstone.

MPH Epidemiology Concentration [EPID]
HLTH 6260 - Analytic Epidemiology (3)
HLTH 6270 - Epidemiologic Methods (3)
HLTH 6271 - Public Health Data Analysis (3)
HLTH 6280 - Epidemiology Capstone (3)

Plus one of the following:
HLTH 6273 - Infectious Disease Epidemiology (3)
HLTH 6274 - Chronic Disease Epidemiology (3)
HLTH 6275 - Reproductive Epidemiology (3)
HLTH 6276 - Environmental and Occupational Epidemiology (3)

Plus one of the following:
Any additional 3-credit hour HLTH or HCIP course

MPH Community Health Practice Concentration [CHPR]
HLTH 6220 - Applied Health Behavior Change (3)
HLTH 6225 - Health Education and Health Promotion (3)
HLTH 6226 - Community Health Methods (3)
HLTH 6227 - Community Health Planning and Evaluation (3)
HLTH 6228 - Social Determinants of Health (3)
HLTH 6230 - Community Health Practice Capstone (3)

** Students in the MPH/M.S. in Health Informatics and Analytics Dual Degree Program cannot pursue the MPH concentration in Population Health Analytics [PHAN].*

Internship (3 credit hours)
Students pursue a single internship relevant to both Public (population) Health and Health Informatics and Analytics.

HLTH 6471 - Public Health Internship (3)

Interprofessional Elective Course (3 credit hours)
In consultation with the MPH Graduate Program Director, students select one 3-credit master's level course from any discipline outside the Department of Public Health Sciences. The course taken to fulfill this requirement cannot carry a HADM, HCIP, HLTH, or HSRD prefix, or be cross-listed with a course bearing one of those prefixes.

Dual Degree Total = 63 Credit Hours

SOCIAL WORK

- Master of Social Work (MSW)
- Graduate Certificate in Early Childhood Mental Health *(see the College of Education section)*

Department of Social Work
socialwork.charlotte.edu

Master of Social Work (MSW)

The Master of Social Work (MSW) program offers an advanced generalist concentration that embraces the profession's commitment to social and economic justice, individual and community well-being, and scientific inquiry. As a reflection of UNC Charlotte's designation as North Carolina's urban research university, our curriculum is especially focused on the needs of vulnerable populations in the growing urban and suburban areas of the state. Graduates of the program will be able to synthesize and apply a broad range of knowledge and skills in order to refine and advance the quality of social work practice and the profession in a range of settings.

Admission Requirements
The following are given consideration in the admission process:

1) Undergraduate Preparation, including GPA
   - The Graduate School sets a 3.0 as the minimum GPA for admission to master's programs
   - The Graduate School requires students to provide copies of unofficial transcripts for all institutions the applicant has attended
   - The School of Social Work seeks applicants with a liberal arts background. Previous courses in biology and statistics are encouraged, but not required.
2) Three Recommendations
3) Relevant Volunteer and/or Paid Experience
4) Personal Statement - See the MSW program website for details

International applicants may be required by The Graduate School to submit additional materials.

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Upon acceptance to the program, students are asked to complete an Intent to Enroll Form.

Degree Requirements

The MSW curriculum promotes its mission and goals through the Foundation curriculum and the Advanced curriculum. The Foundation curriculum prepares students to apply generalist social work knowledge, skills, and values. The Advanced curriculum prepares students for more specialized application of the profession's knowledge, skills, and values, with special attention to the needs of vulnerable populations. All students must successfully complete SOWK 7651, which serves as the capstone course for the MSW.

The MSW may be pursued through the One-Year (Advanced Standing), Two-Year, or Three-Year plans of study.

One Year (Advanced Standing) Plan of Study

The Advanced Standing plan of study is designed for students who have earned a BSW from an accredited social work program within the past seven years and wish to pursue the MSW. Advanced Standing students are not required to complete the Foundation curriculum for the MSW. Under the Advanced Standing plan of study, the MSW can be completed in one calendar year. Students complete 39 graduate credit hours, which includes 33 credit hours in the classroom and 6 credit hours in an approved field placement.

Classes begin during Extended Summer Session, which meets on the main University campus for 10 weeks in the summer months. Advanced Standing students complete 9 credit hours of graduate level coursework designed to bridge the gap between their BSW curriculum and the Advanced MSW curriculum. In the Fall and Spring semesters, students complete the Advanced curriculum along with students completing the Two-Year plan of study.

Summer (9 credit hours)
SOWK 6232 - Practice and Program Evaluation (3)
SOWK 6242 - Advocacy and Policy Change (3)
SOWK 6252 - Mental Health Assessment (3)

Fall (15 credit hours)
SOWK 7122 - Advanced Social Work Practice with Individuals (3)
SOWK 7126 - Advanced Social Work Practice with Groups (3)
SOWK 7222 - Advanced Social Work Practice with Communities and Organizations I (3)
SOWK 7443 - Advanced Social Work Practicum I (3)
Elective Course (3)*

Spring (15 credit hours)
SOWK 7127 - Advanced Social Work Practice with Families (3)
SOWK 7223 - Advanced Social Work Practice with Communities and Organizations II (3)
SOWK 7444 - Advanced Social Work Practicum II (3)
SOWK 7651 - Reflection and Synthesis (3)
Elective Course (3)*

** Advanced Standing MSW students work with their advisors to choose two elective courses that reflect their individual professional interests and goals. Elective courses may be from any academic discipline but must relate to the School of Social Work's mission to work with vulnerable populations.*

Degree Total = 39 Credit Hours

Two-Year Plan of Study

The Two-Year MSW plan of study is designed for students to complete the MSW through two years of intensive study. The Foundation curriculum is completed during the first year of study and the Advanced curriculum is completed during the second year. Classes meet at the main University campus. Students complete a total of 60 graduate credit hours, which includes 48 credit hours in the classroom and 12 credit hours in an approved field placement.

Year One – Foundation Curriculum

Fall (15 credit hours)
SOWK 6121 - Social Work Practice: Theories and Skills (3)
SOWK 6131 - Social Work Research (3)
SOWK 6141 - Foundations of Social Work (3)
SOWK 6151 - Social Work, Social Justice, and Diversity (3)
SOWK 6441 - Foundation Social Work Practicum I (3)

Spring (15 credit hours)
SOWK 6232 - Practice and Program Evaluation (3)
SOWK 6242 - Advocacy and Policy Change (3)
SOWK 6252 - Mental Health Assessment (3)
SOWK 6442 - Foundation Social Work Practicum II (3)
Elective Course (3)*

Year Two – Advanced Curriculum

Fall (15 credit hours)
SOWK 7122 - Advanced Social Work Practice with Individuals (3)
SOWK 7126 - Advanced Social Work Practice with Groups (3)
SOWK 7222 - Advanced Social Work Practice with Communities and Organizations I (3)
SOWK 7443 - Advanced Social Work Practicum I (3)
Elective Course (3)*

Spring (15 credit hours)
SOWK 7127 - Advanced Social Work Practice with Families (3)

SOWK 7223 - Advanced Social Work Practice with Communities and Organizations II (3)
SOWK 7444 - Advanced Social Work Practicum II (3)
SOWK 7651 - Reflection and Synthesis (3)
Elective Course (3)*

** Two-Year MSW students work with their advisors to choose three elective courses that reflect their individual professional interests and goals. Elective courses may be from any academic discipline but must relate to the School of Social Work's mission to work with vulnerable populations.*

Degree Total = 60 Credit Hours

Three-Year Plan of Study

Year One – Foundation Curriculum
Summer (6 credit hours)
SOWK 6121 - Social Work Practice: Theories and Skills (3)
SOWK 6141 - Foundations of Social Work (3)

Fall (9 credit hours)
SOWK 6131 - Social Work Research (3)
SOWK 6151 - Social Work, Social Justice, and Diversity (3)
Elective Course (3)*

Spring (9 credit hours)
SOWK 6232 - Practice and Program Evaluation (3)
SOWK 6242 - Advocacy and Policy Change (3)
Elective Course (3)*

Summer (3 credit hours)
SOWK 6252 - Mental Health Assessment (3)

Year Two – Foundation and Advanced Curriculum
Fall (9 credit hours)
SOWK 6441 - Foundation Social Work Practicum I (3)
SOWK 7122 - Advanced Social Work Practice with Individuals (3)
SOWK 7222 - Advanced Social Work Practice with Communities and Organizations I (3)

Spring (9 credit hours)
SOWK 6442 - Foundation Social Work Practicum II (3)
SOWK 7127 - Advanced Social Work Practice with Families (3)
SOWK 7223 - Advanced Social Work Practice with Communities and Organizations II (3)

Summer (3 credit hours)
Elective Course (3)*

Year Three – Advanced Curriculum
Fall (6 credit hours)
SOWK 7126 - Advanced Social Work Practice with Groups (3)
SOWK 7443 - Advanced Social Work Practicum I (3)

Spring (6 credit hours)
SOWK 7444 - Advanced Social Work Practicum II (3)
SOWK 7651 - Reflection and Synthesis (3)

** Three-Year MSW students work with their advisors to choose three elective courses that reflect their individual professional interests and goals. Elective courses may be from any academic discipline but must relate to the School of Social Work's mission to work with vulnerable populations.*

Degree Total = 60 Credit Hours

Field Placement

Field placements are assigned from a variety of agencies and practice settings approved by the UNC Charlotte School of Social Work Office of Field Experiences. Field Instructors, approved by the School of Social Work, guide the student through learning experiences, coordinating field experiences with the concurrent classroom coursework. The Foundation field placement prepares students to apply generalist social work knowledge, skills, and values. The Advanced field placement prepares students for more specialized application, with special attention to the needs of vulnerable populations.

Financial Assistance

Paid internships and assistantships are limited. Visit socialwork.charlotte.edu for more information.

State Certification

Graduates of the MSW Program may pursue state licensure or certification at the graduate level. Application for licensure or certification should be made with the state board in the state where the applicant intends to practice social work. In North Carolina, the Certification and Licensure Board for Social Work may be accessed on the web at ncswboard.org or by phone at 336-625-1679. MSW levels of licensure/certification in North Carolina include the following: Licensed Clinical Social Worker (LCSW), Licensed Clinical Social Worker Associate (LCSWA), Certified Master Social Worker (CMSW), and Certified Social Work Manager (CSWM).

Special Programs

North Carolina Child Welfare Education Collaborative
UNC Charlotte participates in the North Carolina Child Welfare Education Collaborative, which is a joint effort of the NC Division of Social Services, the NC Association of County Directors of Social Services (DSS), and the National Association of Social Workers NC Chapter, to improve the quality of public child welfare services in North Carolina. The program is administered by the Jordan Institute for Families at UNC Chapel Hill. At UNC

Charlotte, Child Welfare Education Collaborative MSW students complete the course SOWK 5103 (Child Welfare) as one of their electives. They also complete their graduate field placements in a child welfare agency. Students who complete all requirements for the Collaborative program receive a certificate indicating they have successfully met North Carolina Child Welfare Pre-service Training competencies. Graduates may then be hired at a NC County DSS with credit for six (6) months of experience.

For additional information about the North Carolina Child Welfare Education Collaborative at UNC Charlotte, please contact the UNC Charlotte Child Welfare Collaborative Liaison.

School Social Work

Graduates of the program may also qualify for licensure as a school social worker in the state of North Carolina.

The School Social Work license is awarded by the North Carolina Department of Public Instruction. To be eligible for school social work licensure, MSW students must complete a two-semester field placement in a school setting, take SOWK 5102 (School Social Work), and take another course from a list of approved electives. Students interested in school social work licensure should begin planning with their advisors and the MSW Field Education Director as early in the program as possible.

The School of Social Work's Field Education Director has additional information about school social work licensure requirements. Information is also available online at ncsswa.org.

College of Liberal Arts & Sciences

clas.charlotte.edu

The College of Liberal Arts & Sciences is the largest of the seven discipline-based colleges at the University of North Carolina at Charlotte, housing 18 academic departments and numerous interdisciplinary programs. The College serves the Charlotte region and the state of North Carolina and is engaged in the discovery, dissemination, synthesis and application of knowledge. It provides for the educational, economic, social, and cultural advancement of the people of North Carolina through on-and off-campus programs, continuing personal and professional education opportunities, research and collaborative relationships with the private, public, and nonprofit institutional resources of the greater Charlotte metropolitan region. The College offers a wide array of graduate programming including graduate certificate, Master of Arts, Master of Science, and Ph.D. programs.

Graduate Degree Programs

- Master of Arts in Anthropology
- Master of Arts in Anthropology and Master of Public Health Dual Degree *(see College of Health and Human Services section)*
- Master of Arts in Communication Studies
- Master of Arts in English
- Master of Arts in Ethics and Applied Philosophy
- Master of Arts in Geography
- Master of Arts in History
- Master of Arts in Latin American Studies
- Master of Arts in Liberal Studies
- Master of Arts in Psychology
- Master of Arts in Industrial/Organizational Psychology
- Master of Arts in Religious Studies
- Master of Arts in Sociology
- Master of Arts in Spanish
- Master of Public Administration
- Master of Science in Applied Physics
- Master of Science in Biology
- Master of Science in Chemistry
- Master of Science in Criminal Justice
- Master of Science in Earth Sciences
- Master of Science in Mathematics
- Master of Science in Mathematical Finance *(see the Belk College of Business section)*
- Master of Science in Optical Science and Engineering *(with The William States Lee College of Engineering)*
- Ph.D. in Applied Mathematics
- Ph.D. in Biology
- Ph.D. in Geography
- Ph.D. in Health Psychology *(with Colleges of Education and Health & Human Services)*
- Ph.D. in Infrastructure and Environmental Systems *(see The William States Lee College of Engineering section)*
- Ph.D. in Nanoscale Science

- Ph.D. in Optical Science and Engineering *(with The William States Lee College of Engineering)*
- Ph.D. in Organizational Science
- Ph.D. in Public Policy

Graduate Non-Degree Programs

- Graduate Certificate in Africana Studies
- Graduate Certificate in Applied Ethics
- Graduate Certificate in Applied Linguistics
- Graduate Certificate in Biomedical Sciences
- Graduate Certificate in Biotechnology
- Graduate Certificate in Cognitive Science
- Graduate Certificate in Crime Analysis
- Graduate Certificate in Emergency Management
- Graduate Certificate in Gender, Sexuality, and Women's Studies
- Graduate Certificate in Geographic Information Science and Technology
- Graduate Certificate in Gerontology
- Graduate Certificate in Languages and Culture Studies: Business Languages
- Graduate Certificate in Languages and Culture Studies: Translating
- Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies, Spanish-English
- Graduate Certificate in Nonprofit Management
- Graduate Certificate in Public Budgeting and Finance
- Graduate Certificate in Public Policy Research and Analysis
- Graduate Certificate in Technical/Professional Writing
- Graduate Certificate in Urban Management and Policy

AFRICANA STUDIES

- Graduate Certificate in Africana Studies

Department of Africana Studies

africana.charlotte.edu

Graduate Certificate in Africana Studies

The Graduate Certificate in Africana Studies is designed for students interested in the global African and African Diaspora experience, with emphasis on history, culture, and social policy. The program provides advanced credential of analytical knowledge and skills in any area of Africana Studies. The certificate can be earned either as a freestanding course of study or in conjunction with master's or doctoral work in a wide variety of subjects, especially in the Humanities, Social Sciences, Arts and Architecture, Education, and Health Sciences. The graduate certificate curriculum is interdisciplinary and courses offered will provide students with advanced knowledge of the intersecting issues of race, identity, culture and aesthetics, history, globalization, development, and social policy.

Admission Requirements

Applications for admission to the Graduate Certificate in Africana Studies will be considered as they are received, and admissions will be ongoing. To be considered for admission, an applicant must (1) hold a bachelor's degree from a college or university accredited by an accepted accrediting body, and with a minimum cumulative grade point average of 3.0 (based on a 4.0 scale); or (2) be enrolled and in good standing in a graduate degree program at UNC Charlotte. If the applicant has earned or attempted a post-baccalaureate degree (i.e., master's, doctoral, or other), grades in that program will also be taken into consideration.

In addition to the general requirements for graduate certificate programs as explained at the beginning of this *Catalog,* an applicant must provide official transcripts, three letters of recommendation from persons familiar with the applicant's personal and professional qualifications, and a two-page statement of purpose explaining their educational and work background, interests, and plans, with an emphasis on how this certificate will enhance, complement, or advance the applicant's professional goals and/or personal education.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

To obtain a Graduate Certificate in Africana Studies, admitted students will complete 15 credit hours.

Required Courses (6 credit hours)

AFRS 6610 - Diaspora and Transnational Theories (3)

Plus one of the following:
AFRS 6620 - Advanced Readings in African Modernities (3)
AFRS 6630 - Graduate Colloquium (3)
AFRS 6901 - Directed Readings/Research (3)

Elective Courses (9 credit hours)*

AFRS 5000 - Special Topics in Africana Studies (3)
AFRS 6620 - Advanced Readings in African Modernities (3)
AFRS 6630 - Graduate Colloquium (3)
AFRS 6901 - Directed Readings/Research (3)
ANTH 5090 - Topics in Anthropology (3)**
CSLG 6145 - Multicultural and Social Justice Counseling (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Life (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 6070 - Topics in English (3)**
ENGL 6147 - Perspectives in African American Literature (3)
HIST 5000 - Problems in American History (when topic is related to Africana Studies) (3)
HIST 5002 - Problems in Non-Western History (3)**
HIST 6000 - Topics in History (3)**
LTAM 5600 - Seminar in Latin American Studies (when topic is related to Africana Studies) (3)
LTAM 6251 - Colloquium on Colonial Latin American History (3)**
LTAM 6252 - Colloquium on Modern Latin American History (3)**
PHIL 6050 - Race and Philosophy (3)
TESL 6204 - Multicultural Education (3)

**Other elective courses may be selected, with the approval of the Graduate Program Director, from any UNC Charlotte graduate courses relevant to Africana Studies.*

***When topic is related to Africana Studies.*

Certificate Total = 15 Credit Hours

All or part of the 15-hour credit courses may count towards a M.A. or Ph.D. program in which the student is enrolled, provided that the courses are approved for that purpose by the advisors of that program. Students must have a minimum grade point of 3.0 in each course that counts towards the certificate. The award of the graduate certificate is carried on the student's official transcript upon completion of the program. Students in another degree programs must enroll concomitantly in the certificate program. The certificate will not be awarded retroactively.

ANTHROPOLOGY

- M.A. in Anthropology
  - Applied Anthropology
  - Medical Anthropology
  - General Anthropology
- M.A. in Anthropology/Master of Public Health (MPH) Dual Degree *(see College of Health and Human Services section)*

Department of Anthropology
anthropology.charlotte.edu

M.A. in Anthropology

Anthropology is an integrative and comparative field of scholarship devoted to discovering and analyzing the range of human biological and cultural variation, as well as to understanding the historical, ecological, and sociopolitical contexts in which human diversities and commonalities develop. The field encompasses and integrates cultural anthropology (the study of living communities), linguistic anthropology (the study of the human use of language), biological anthropology (the study of humans' primate relatives, human evolution, and modern biological variation), and archaeology (the study of the culture of past communities). The Master of Arts in Anthropology degree program will provide students with the theoretical and methodological skills to gather, record, analyze, and communicate about human activity patterns in the past and present, and at local and global levels.

The M.A. in Anthropology is designed to meet the needs of two kinds of students: those seeking to prepare for doctoral education in anthropology or other fields and those seeking post-baccalaureate skills for employment in a wide range of occupations in our increasingly intercultural and international world: education, government, program planning and evaluation, healthcare, media, the nonprofit sector, and business. Coursework in the program will build skills in data collection, analysis, and interpretation, and the application of anthropological perspectives to both theoretical and applied problems.

The M.A. in Anthropology has the following educational objectives:

- to provide opportunities for post-baccalaureate study about the human species from evolutionary and cross-cultural perspectives;
- to provide training for the application of anthropological techniques and perspectives to contemporary social problems;
- to expand cross-cultural understanding within regional and national communities and institutions;
- to expand understanding of the complex interconnections between local communities and global environments, both natural and social;
- to emphasize the importance of cross-disciplinary, biocultural approaches to research on the human species.

Admission Requirements

In addition to meeting the University's graduate admission requirements, all prospective students must submit:

- A minimum of three letters of reference, of which at least two are from academic sources
- B.A. in Anthropology or a related field, such as Area Studies, History, Biology, Sociology, etc.
- GPA of at least 3.0 in the student's undergraduate degree

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The M.A. in Anthropology requires the completion of a minimum of 33 credit hours of approved graduate work. The successful completion of a Capstone, in the form of a Thesis or a Practicum, is also required.

Core Courses (12 credit hours)

Required Core Course

ANTH 6601 - History of Anthropology (3)

Elective Core Courses

Select two of the following:

ANTH 6603 - Theory in Cultural Anthropology (3)
ANTH 6604 - Archaeological Theory and Practice (3)
ANTH 6605 - Evolutionary and Biological Anthropology (3)
ANTH 6606 - Foundational Issues in Linguistic Anthropology (3)

Select one of the following:

ANTH 5122 - Ethnographic Methods (3)
ANTH 5140 - Field Biology of the Primates
ANTH 5453 - Field Project in Archaeology (1 to 4)
ANTH 5641 - Bioarchaeology Methods (3)

Concentration Courses (21 credit hours)

Select from the Applied Anthropology and Medical Anthropology concentrations or complete the General Anthropology requirements. All students must complete either a thesis or a practicum to meet the capstone requirement for their selected concentration. Students in the General Anthropology concentration complete a research-based thesis. Students in the Applied Anthropology and Medical Anthropology concentrations complete a research-based report as part of a practicum with an organization, institution, or agency. As part of their elective course requirements, students in any concentration may also earn up to 6 credit hours in programs outside of the Department of Anthropology, with approval of the Graduate Program Director.

Applied Anthropology Concentration

Required Courses

ANTH 6611 - Seminar in Applied Anthropology (3)
ANTH 6400 - Anthropology Practicum (3)

Elective Courses

Select five courses from the following:

ANTH 5XXX - Anthropology Elective (3)
ANTH 6XXX - Anthropology Elective (3)

Medical Anthropology Concentration

Required Courses

ANTH 6611 - Seminar in Applied Anthropology (3)
ANTH 6613 - Seminar in Medical Anthropology (3)
ANTH 6400 - Anthropology Practicum (3)

Elective Courses

Select four courses from the following:

ANTH 5XXX - Anthropology Elective (3)
ANTH 6XXX - Anthropology Elective (3)

General Anthropology Concentration

Required Courses

ANTH 6910 - Thesis Tutorial (3)
ANTH 6920 - Master's Thesis (3)

Elective Courses

Select five courses from the following:

ANTH 5XXX - Anthropology Elective (3)
ANTH 6XXX - Anthropology Elective (3)

Degree Total = 33 Credit Hours

Grade Requirements

Students must complete all required coursework with a GPA of 3.0 or above.

Advising

The Graduate Program Director appoints an advisor for each graduate student from among the Anthropology Graduate Faculty.

Committees

Each student forms a committee of three faculty with the advice of the Graduate Program Director. One of these committee members may come from another department.

Foreign Language Requirement

There is no specific language requirement, but students in the General Anthropology concentration are encouraged to pursue appropriate language study.

Application to Graduation

Students must complete an Application for Graduation by the deadline date specified in the official University academic calendar in the semester in which they plan to graduate. Details are available on the Graduate School website at graduateschool.charlotte.edu/current-students/graduation-clearance.

Assistantships

The Department offers a limited number of graduate assistantships. Awards are made on a competitive basis after acceptance to the program. Interested students should complete the Graduate Assistantship Application online at graduateschool.charlotte.edu.

M.A. in Anthropology / Master of Public Health (MPH) Dual Degree

This dual degree program allows students to earn both a Master of Arts in Anthropology degree from the College of Liberal Arts & Sciences and a Master of Public Health (MPH) degree from the College of Health and Human Services. Students are expected to meet the admission requirements of both programs to participate in the dual degree program. For details, see the College of Health and Human Services section of this *Catalog*.

BIOLOGY

- Ph.D. in Biology
  - Ecology, Evolution, and Environmental Biology
  - Molecular, Cellular, and Developmental Biology
- M.S. in Biology
  - Ecology, Evolution, and Environmental Biology
  - Molecular, Cellular, and Developmental Biology
- Graduate Certificate in Biomedical Sciences
- Graduate Certificate in Biotechnology

Department of Biological Sciences
biology.charlotte.edu

Ph.D. in Biology

The Ph.D. in Biology program has as its intellectual focus an interdisciplinary synthesis of the biological sciences and related biotechnology. In addition to a vigorous research concentration, the program emphasizes the importance of relevant coursework. All students are required to complete a series of core courses related to the interdisciplinary nature of the program. Students must choose either (1) the Ecology, Evolution, and Environmental Biology (E3B) or (2) the Molecular, Cellular, and Developmental Biology (MCD) concentration or concentration before selecting elective courses. The cornerstone of the program is the student's research dissertation. Each dissertation is expected to be a significant scientific contribution based on independent and original research, leading to publications in national/international peer-reviewed journals.

For further information, please see the department website at biologicalsciences.charlotte.edu.

Admission Requirements
Applicants will be evaluated in a holistic manner to identify those who have the greatest potential for success. In addition to the general requirements for admission to the Graduate School, to begin study toward the Interdisciplinary Ph.D. in Biology, students admitted to the program should have:

1) A B.S. or B.A. degree from a college or university accredited by an accepted accrediting body.
2) An overall grade point average of at least 3.0 out of 4.0. Additionally, applicants must have a grade point average of at least 3.5 in biology, 3.0 in chemistry, and 3.0 in mathematics.
3) A minimum of 24 hours in biology, including at least one course in genetics, physiology, and cell/molecular biology. Additionally, applicants should have one year each of general chemistry, organic chemistry, physics, and mathematics. Applicants with academic deficiencies may be admitted on the condition that any deficiencies are corrected during the first year of graduate study. The Graduate Ph.D. Committee will determine the remediation necessary for identified deficiencies.
4) A score of at least 100 on the Internet-based, 220 on the computer-based, or 557 on the paper-based Test of English as a Foreign Language (TOEFL), or a minimum overall band score of 6.5 on the IELTS, for applicants whose native language is not English. Students who do not pass this examination must pass ENGL 1100 (English as a Foreign Language) with a grade of C or above. In addition, these students who will be involved in any instructional activity (e.g., teaching assistants) will be required to be evaluated by the English Language Training Institute at UNC Charlotte prior to the beginning of the first semester of study.
5) Three letters of reference, at least two of which must be from faculty members.

GRE Waiver
The GRE General Test requirement is waived for all applicants to the Ph.D. in Biology program.

Degree Requirements
The Ph.D. acknowledges the value of coursework as background and preparation for research, but the primary emphasis of the program is on the development of research skills and the completion of a research project on a significant problem in the biological sciences or related biotechnology.

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of courses as shown below.

Core Courses
BIOL 8101 - Hypothesis Testing (3)
BIOL 8102 - Cellular and Molecular Biology (3)
BIOL 8140 - Evolutionary Biology (3)
BIOL 8201 - Seminar (1)

Research and Ethics Course
Select one of the following:
BIOL 8260 - Careers in Bioscience: Professional Development and Responsible Conduct (2)
GRAD 8302 - Responsible Conduct of Research (2)
PHIL 8240 - Research Ethics in the Biological and Behavioral Sciences (3)

Concentration Required Course

Select one of the following, based on concentration:

BIOL 8241 Environmental Biology (3) *(for students pursuing the Ecology, Evolution and Environmental Biology (E3B) concentration)*

BIOL 8270 - Biological Pathways and Metabolism (3) *(for students pursuing the Molecular, Cellular and Developmental Biology (MCD) concentration)*

Concentration Elective Courses

Students should select a minimum of 9 credit hours of elective courses; to be determined in consultation with the student's Dissertation Committee, but typically will consist of at least three 3 credit hour courses from either the MCD or E3B concentration. At least half the total elective hours, including the concentration requirement must be at the 8000-level. Elective courses outside the concentration may be substituted upon approval from the Supervisory Committee and Graduate Program Director.

Ecology, Evolution, and Environmental Biology Concentration Elective Courses

Select from the following:

BIOL 5000 - Advanced Topics in Biology (1 to 4)
BIOL 5111 - Evolution (3)
BIOL 5121 - Advanced Biometry (4)
BIOL 5144 - Advanced Ecology (4)
BIOL 5162 - Advanced Biotechnology I (3)
BIOL 5163 - Advanced Biotechnology II (3)
BIOL 5168 - Recombinant DNA Techniques (4)
BIOL 5184 - Plant Biotechnology (3)
BIOL 5189 - Mechanisms in Development (3)
BIOL 5199 - Molecular Biology (3)
BIOL 5205 - Advanced Horticulture (3)
BIOL 5221 - Plant Systematics (4)
BIOL 5229 - Dendrology (4)
BIOL 5234 - Wildlife Biology (3)
BIOL 5235 - Mammalogy (4)
BIOL 5242 - The Biology of Birds (3)
BIOL 5242L - The Biology of Birds Lab (1)
BIOL 5243 - Animal Behavior (3)
BIOL 5244 - Conservation Biology (3)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5253 - Marine Microbiology (4)
BIOL 5257 - Microbial Physiology and Metabolism (3)
BIOL 5260 - Population Genetics (3)
BIOL 5277 - Endocrinology (3)
BIOL 5282 - Developmental Plant Anatomy (3)
BIOL 5282L - Developmental Plant Anatomy Laboratory (1)
BIOL 5283 - Developmental Biology (3)
BIOL 5283L - Developmental Biology Laboratory (1)
BIOL 5293 - Comparative Vertebrate Anatomy (4)
BIOL 6000 - Special Topics in Biology (1 to 4)
BIOL 6800 - Tutorial (1 to 4)
BIOL 8000 - Special Topics in Biology (1 to 4)
BIOL 8200 - Interdisciplinary Colloquium (1)
BIOL 8800 - Laboratory Rotations (2)

Molecular, Cellular, and Developmental Biology Concentration Elective Courses

Select from the following:

BIOL 5000 - Advanced Topics in Biology (1 to 4)
BIOL 5121 - Advanced Biometry (4)
BIOL 5162 - Advanced Biotechnology I (3)
BIOL 5163 - Advanced Biotechnology II (3)
BIOL 5167 - Medical Genetics (3)
BIOL 5168 - Recombinant DNA Techniques (4)
BIOL 5171 - Cell Physiology (3)
BIOL 5189 - Mechanisms in Development (3)
BIOL 5199 - Molecular Biology (3)
BIOL 5233 - Parasitology (3)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5251 - Immunology (3)
BIOL 5251L - Immunology Laboratory (1)
BIOL 5254 - Epidemiology (3)
BIOL 5255 - Bacterial Genetics (3)
BIOL 5256 - Pathogenic Bacteriology (3)
BIOL 5256L - Pathogenic Bacteriology Laboratory (1)
BIOL 5257 - Microbial Physiology and Metabolism (3)
BIOL 5258 - Epidemics and Plagues (3)
BIOL 5259 - Advanced Virology (3)
BIOL 5259L - Advanced Virology Laboratory (1)
BIOL 5265 - Drugs: Molecular and Cellular Mechanisms (3)
BIOL 5277 - Endocrinology (3)
BIOL 5279 - Neurobiology (3)
BIOL 5282 - Developmental Plant Anatomy (3)
BIOL 5282L - Developmental Plant Anatomy Laboratory (1)
BIOL 5283 - Developmental Biology (3)
BIOL 5283L - Developmental Biology Laboratory (1)
BIOL 5292 - Advances in Immunology (3)
BIOL 6000 - Special Topics in Biology (1 to 4)
BIOL 6010 - Special Topics in Microbiology (1 to 4)
BIOL 6103 - Immunology of Infection (4)
BIOL 6104 - Integrative Systems Physiology (4)
BIOL 6273 - Advanced Human Physiology (3)
BIOL 6274 - Advanced Human Pathophysiology (3)
BIOL 6800 - Tutorial (1 to 4)
BIOL 8000 - Special Topics in Biology (1 to 4)
BIOL 8010 - Special Topics in Microbiology (1 to 4)
BIOL 8103 - Immunology of Infection (4)
BIOL 8104 - Integrative Systems Physiology (4)
BIOL 8200 - Interdisciplinary Colloquium (1)
BIOL 8201 - Seminar (1)
BIOL 8366 - Advanced Protein Biotechnology (3)
BIOL 8800 - Laboratory Rotations (2)

Dissertation

The doctoral program of study must include a minimum of 18 hours of dissertation credit. Students must complete and defend a dissertation based on a research program approved by their dissertation committee, which results in a high quality, original and substantial piece of research.

Students must orally present and successfully defend the dissertation to their dissertation committee in a defense that is open to the public. A copy of the dissertation must be made available for review by the program doctoral faculty at least two weeks prior to the public defense.

BIOL 8999 - Dissertation Research *(minimum of 18 credit hours)*

Student Teaching

Every student must teach at least once. This requirement is satisfied by being a Graduate Teaching Assistant for one course for one semester.

Degree Total = 72 Credit Hours

Grade Requirements

Students must maintain a cumulative average of 3.0 in all coursework taken for graduate credit. Lab rotations and the dissertation research are graded on a Pass/Unsatisfactory basis and therefore are not included in the cumulative average. An accumulation of one C grade results in suspension from the program; two C grades results in termination of enrollment in the graduate program. If students make a grade of U in any course, enrollment in the program is terminated.

Advancement to Candidacy

For Advancement to Candidacy, students must pass the Qualifying Examination by the end of the 5th semester of study. The Qualifying Examination can be taken only after all coursework for the degree has been completed, with the exception of the Doctoral Dissertation Research. Following successful completion of the Qualifying Examination, a dissertation topic is proposed to the student's Dissertation Committee by the end of the 6th semester of study. Students advance to candidacy following approval of the proposed dissertation topic by their Dissertation Committee and the Dean of the Graduate School.

Deadlines and Time Limits

All requirements for the degree must be completed within nine years after first registration as a doctoral student. Students must achieve admission to candidacy within six years after admission to the program and complete all requirements within six years after admission to candidacy for the Ph.D. degree. These time limits are maxima; students are typically expected to complete the degree requirements within five years.

a) A student must have an advisor by no later than the end of the 2nd semester.
b) A student must establish their Dissertation Committee by the end of the 3rd semester.
c) A student must have a Program of Study/Curriculum Contract approved by the Dissertation Committee by the end of the 3rd semester.
d) The student and Dissertation Committee must meet by the end of the 4th semester to set a timeline for the candidacy exam.
e) The student is required to meet with their Dissertation Committee at least once a year.
f) The deadline for completing the candidacy exam is the end of the student's 5th semester.
g) A student must have a Dissertation Proposal approved by their Dissertation Committee by the end of the 6th semester.

Departmental Seminars

Graduate students are expected to attend all seminars sponsored by the Department of Biological Sciences. In addition, each student is required to make a 20 minute presentation on their research at the departmental seminar after entering their 2nd year in the program. The Graduate Program Director will work out the logistics with the department seminar coordinator concerning the arrangement of students' presentations.

Laboratory Research Rotations

Optional laboratory research rotations allow the student to sample areas of research and become familiar with program faculty. Students may engage in a maximum of 3 rotations. Each rotation consists of a minimum of 4 weeks and there is no expectation that the work done during the rotation results in a publication. By the end of their second semester, students must have determined their major advisor. A rotation must have been completed in the advisor's laboratory.

The purpose of a laboratory rotation is to learn and perform techniques associated with the lab, and to potentially identify a Dissertation Advisor. A typical rotation involves 5-10 hours per week in the laboratory for 4-10 weeks. Students are encouraged to identify a sponsoring faculty member well in advance of the scheduled rotation. Students must meet with the sponsoring faculty member to determine what will be done during the rotation (i.e., techniques to be learned and identification of the project to be completed). At the end of the rotation, students must write a one- to two-page synopsis of the rotation to be signed by the sponsoring faculty member and turned in to the Graduate Program Director.

Obtaining the Non-Thesis M.S. While Completing the Ph.D. Degree

Ph.D. students may choose to receive the non-thesis M.S. degree while continuing to work toward the doctoral degree provided they have successfully completed the Qualifying Examination and completed at least 30 credit

hours of coursework, and two credit hours of BIOL 6800 (Tutorial) culminating in a written assignment developed in consultation with the student's major advisor. Obtaining the non-thesis M.S. requires dual enrollment in the Ph.D. and M.S. programs. Doctoral students can apply for enrollment in the M.S. program after entering the Ph.D. program.

Transfer Credit

Only courses with grades of A or B may be accepted for transfer credit; courses graded IP/P typically cannot be transferred among graduate programs. Although the maximum amount of credit past the baccalaureate degree that a Ph.D. student may count towards the doctorate is 30 credit hours, only courses appropriate for the program and curriculum in which the student is enrolled may be transferred. This should be determined by the student's Dissertation Committee and approved by the Graduate Program Director, before the request is submitted to the Graduate School. This rule applies whether the courses were taken at UNC Charlotte or elsewhere, and whether a Master's degree was earned or not. However, no more than six hours taken when the student was in post-baccalaureate (non-degree seeking) status may be applied toward the doctoral degree.

UNC Charlotte Residency Requirement

Students must satisfy the UNC Charlotte residency requirement for the program by completing 20 credit hours, either as coursework or research credits. Residence is considered to be continuous if students are enrolled in one or more courses in successive semesters until 20 credit hours are earned.

M.S. in Biology

The M.S. in Biology degree program is designed for students who desire to pursue advanced studies in professional and graduate schools or various vocational opportunities in biology and related areas (see biologicalsciences.charlotte.edu). The program provides the opportunity for broad training in a variety of biological areas as well as specialization in areas of particular interest through (1) the Ecology, Evolution, and Environmental Biology (E3B) concentration and (2) the Molecular, Cellular, and Developmental Biology (MCB) concentration. Selection of either concentration is optional.

The Department of Biological Sciences offers the thesis and non-thesis track within the M.S. degree. The thesis track is designed for students whose career goals include formal research training. The non-thesis track is designed for students whose career goals include graduate education, but not formal research experience. Students may switch between the thesis and non-thesis tracks with written approval from their major advisor and the Graduate Program Director.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following requirements are specific to the Department of Biological Sciences:

1) A B.S. or B.A. degree from a college or university accredited by an accepted accrediting body.
2) Evidence of undergraduate preparation in biology with a minimum 24 credit hours in biology and 24 credit hours of cognate study.
3) An overall grade point average of at least 3.0 out of 4.0. Additionally, applicants must have a grade point average of at least 3.0 in biology.
4) A score of at least 100 on the Internet-based, 220 on the computer-based, or 557 on the paper based Test of English as a Foreign Language (TOEFL), or a minimum overall band score of 6.5 on the IELTS, for applicants whose native language is not English. Students who do not pass this examination must pass ENGL 1100 (English as a Foreign Language) with a grade of C or above. In addition, these students who will be involved in any instructional activity (e.g., teaching assistants) will be required to be evaluated by the English Language Training Institute at UNC Charlotte prior to the beginning of the first semester of study.
5) Three letters of reference, at least two of which must be from faculty members.

GRE Waiver

The GRE General Test requirement is waived for all applicants to the M.S. in Biology program.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

All M.S. students must complete 30 credit hours of coursework approved by a Supervisory Committee, including the following courses:

Required Courses

BIOL 6101 - Hypothesis Testing (3)
BIOL 6102 - Cellular and Molecular Biology (3)
BIOL 6140 - Evolutionary Biology (3)

Research and Ethics Course

Select one of the following:

BIOL 6260 - Careers in Bioscience: Professional Development and Responsible Conduct (2)
GRAD 6302 - Responsible Conduct of Research (2)
PHIL 6240 - Research Ethics in the Biological and Behavioral Sciences (3)

Concentration Elective Courses

Students may choose either (1) the Ecology, Evolution, and Environmental Biology (E3B) concentration or (2) the Molecular, Cellular, and Developmental Biology (MCD) concentration when selecting elective courses, although selection of a concentration is not required. Elective courses outside the concentration may be substituted upon approval from the Supervisory Committee and Graduate Program Director. In addition to coursework, each degree candidate must pass an oral candidacy examination administered by the Supervisory Committee.

Ecology, Evolution, and Environmental Biology (E3B) Concentration Elective Courses

Select from the following:

BIOL 5000 - Advanced Topics in Biology (1 to 4)
BIOL 5111 - Evolution (3)
BIOL 5121 - Advanced Biometry (4)
BIOL 5144 - Advanced Ecology (4)
BIOL 5162 - Advanced Biotechnology I (3)
BIOL 5163 - Advanced Biotechnology II (3)
BIOL 5168 - Recombinant DNA Techniques (4)
BIOL 5184 - Plant Biotechnology (3)
BIOL 5189 - Mechanisms in Development (3)
BIOL 5199 - Molecular Biology (3)
BIOL 5205 - Advanced Horticulture (3)
BIOL 5221 - Plant Systematics (4)
BIOL 5229 - Dendrology (4)
BIOL 5234 - Wildlife Biology (3)
BIOL 5235 - Mammalogy (4)
BIOL 5242 - The Biology of Birds (3)
BIOL 5242L - The Biology of Birds Lab (1)
BIOL 5243 - Animal Behavior (3)
BIOL 5244 - Conservation Biology (3)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5253 - Marine Microbiology (4)
BIOL 5257 - Microbial Physiology and Metabolism (3)
BIOL 5260 - Population Genetics (3)
BIOL 5277 - Endocrinology (3)
BIOL 5282 - Developmental Plant Anatomy (3)
BIOL 5282L - Developmental Plant Anatomy Laboratory (1)
BIOL 5283 - Developmental Biology (3)
BIOL 5283L - Developmental Biology Laboratory (1)
BIOL 5293 - Comparative Vertebrate Anatomy (4)
BIOL 6000 - Special Topics in Biology (1 to 4)
BIOL 6800 - Tutorial (1 to 4)

Molecular, Cellular, and Developmental Biology (MCD) Concentration Elective Courses

Select from the following:

BIOL 5000 - Advanced Topics in Biology (1 to 4)
BIOL 5121 - Advanced Biometry (4)
BIOL 5162 - Advanced Biotechnology I (3)
BIOL 5163 - Advanced Biotechnology II (3)
BIOL 5167 - Medical Genetics (3)
BIOL 5168 - Recombinant DNA Techniques (4)
BIOL 5171 - Cell Physiology (3)
BIOL 5189 - Mechanisms in Development (3)
BIOL 5199 - Molecular Biology (3)
BIOL 5233 - Parasitology (3)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5251 - Immunology (3)
BIOL 5251L - Immunology Laboratory (1)
BIOL 5254 - Epidemiology (3)
BIOL 5255 - Bacterial Genetics (3)
BIOL 5256 - Pathogenic Bacteriology (3)
BIOL 5256L - Pathogenic Bacteriology Laboratory (1)
BIOL 5257 - Microbial Physiology and Metabolism (3)
BIOL 5258 - Epidemics and Plagues (3)
BIOL 5259 - Advanced Virology (3)
BIOL 5259L - Advanced Virology Laboratory (1)
BIOL 5265 - Drugs: Molecular and Cellular Mechanisms (3)
BIOL 5277 - Endocrinology (3)
BIOL 5279 - Neurobiology (3)
BIOL 5282 - Developmental Plant Anatomy (3)
BIOL 5282L - Developmental Plant Anatomy Laboratory (1)
BIOL 5283 - Developmental Biology (3)
BIOL 5283L - Developmental Biology Laboratory (1)
BIOL 5292 - Advances in Immunology (3)
BIOL 6000 - Special Topics in Biology (1 to 4)
BIOL 6010 - Special Topics in Microbiology (1 to 4)
BIOL 6103 - Immunology of Infection (4)
BIOL 6104 - Integrative Systems Physiology (4)
BIOL 6273 - Advanced Human Physiology (3)
BIOL 6274 - Advanced Human Pathophysiology (3)
BIOL 6366 - Advanced Protein Biotechnology (3)
BIOL 6800 - Tutorial (1 to 4)

M.S. Degree: Thesis Track

At least 16 of the 30 credit hours required for the degree, including no more than eight hours of thesis research, must be in courses at the 6000-level. The candidate must prepare a written thesis based upon original research acceptable to the Supervisory Committee and the Dean of the Graduate School. Students have the opportunity to conduct their thesis research under the co-direction of a Biology faculty member and select faculty at the Carolinas Medical Center in Charlotte. The student must orally present and successfully defend the thesis to the student's Supervisory Committee in a defense open to the public.

M.S. Degree: Non-Thesis Track
At least 12 of the 30 credit hours required for the degree must be in courses at the 6000-level, including two credit hours of BIOL 6800 (Tutorial) culminating in a written assignment developed in consultation with the major advisor. A maximum of two credit hours of non-thesis research (BIOL 6901) may be taken as an elective, and students are encouraged to gain research experience. No written thesis or oral thesis defense is required for the non-thesis track.

Proportion of Courses Open Only to Graduate Students
At least 16 of the 30 required hours, including no more than eight hours of thesis research, must be in courses open to graduate students only.

Degree Total = 30 Credit Hours

Grade Requirement
Students must maintain a cumulative average of 3.0 in all coursework taken for graduate credit. An accumulation of two C grades results in suspension from the Master's program. An accumulation of more than two C grades results in termination of enrollment in the Master's program. If students make a grade of U in any course, enrollment in the program is terminated.

Transfer Credit
Up to 6 hours of transfer credit may be applied to the Master's degree. Only courses with grades of A or B may be accepted for transfer credit. Courses taken to satisfy the requirements of a previously completed degree cannot be counted toward the Master's degree. All transfer credit must be approved by the student's Thesis Committee and the Graduate Program Director.

Departmental Seminars
Graduate students are expected to attend all seminars sponsored by the Department of Biological Sciences.

Student Teaching
Every student must teach at least once. This requirement is satisfied by being a Graduate Teaching Assistant for one course for one semester.

Deadlines/Progression Requirements
1) All M.S. students must establish their Supervisory Committee by the end of the 2nd semester. The Committee must be established before approving the Curriculum Contract and taking the Oral Candidacy exam. For thesis-track students, the Supervisory Committee must also be established before approving the Thesis Proposal.
2) The Curriculum Contract must be approved no later than the end of the 2nd semester and preferably by the end of the 1st semester.
3) The Oral Candidacy exam must be approved before the beginning of the 3rd semester. All required coursework for the degree, with the exception of the Tutorial requirement for non-thesis track students and Research and Thesis for thesis-track students, must be completed before taking the Candidacy Examination. For thesis-track students, completion of the Candidacy exam must precede approval of the Thesis Proposal.
4) For thesis-track students, the Thesis Proposal must be approved before the beginning of the 3rd semester.
5) The student is required to meet with their Supervisory Committee at least once a year.

Admission to Candidacy
General academic regulations will apply to admission to candidacy. In addition to these the applicant should have:
1) Removed any identified entrance deficiencies by the time of application.
2) Successfully completed the Qualifying Examination, which can be taken only after the completion of all required coursework for the degree, with the exception of the Tutorial requirement for the non-thesis track, and Research and Thesis for the thesis-track.
3) Taken at least 15 credit hours of graduate work with a GPA of 3.0 or above.
4) Satisfied the Supervisory Committee that they are qualified to become a candidate, i.e., can fulfill the requirements successfully.

Assistantships
Teaching and research assistantships are available on a competitive basis for qualified students. A limited number of tuition grants are also competitively awarded. Typically, thesis-track M.S. students are prioritized above non-thesis track students for funding awards.

Graduate Certificate in Biomedical Sciences

The Graduate Certificate in Biomedical Sciences is offered by the Department of Biological Sciences and provides students with core competencies or exposure to areas of study in the biomedical sciences to prepare them for professional biomedical schools, including -- but not limited to -- medical, veterinary, and dental schools. In addition, certificate students are able to transfer credit hours into the M.S. or Ph.D. in Biology programs should they modify their career goals. Certificate students are able to choose from a number of existing course offerings in the Biology program that expose them to broad areas of anatomy and physiology; biochemical principles and metabolic pathways; microbiology, immunology, and infection; embryology, cell biology, and development.

The 15 required credit hours for the certificate must be completed within four years of study starting from the time the first course is taken. Courses taken for one graduate certificate may not be counted toward another graduate certificate. Up to 6 credit hours of graduate coursework taken as post-baccalaureate status at UNC Charlotte may be applied toward the Graduate Certificate in Biomedical Sciences. Credit hours earned in the certificate program may be applied to the master's or doctoral program in Biology pursued either in conjunction with or after the certificate has been awarded subject to admission to that graduate program.

Admission Requirements

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- Minimum GPA of 2.8 (based on a 4.0 scale) on all previous work completed beyond high school (secondary school)
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college coursework attempted
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and the applicant has not earned a post-secondary degree from a U.S. institution
- Given that certificates are not degree programs and are intended to provide streamlined educational opportunities, standardized test scores (e.g., GRE, GMAT, MAT) are not required for admission

Certificate Requirements

The Graduate Certificate in Biomedical Sciences requires completion of 15 credit hours of elective courses in biomedical sciences selected from the list below. A maximum of 3 credit hours in BIOL 6901 may be used for the certificate.

BIOL 5000 - Advanced Topics in Biology (1 to 4) *(Cardiovascular Physiology, Comparative Animal Physiology topics)*
BIOL 5121 - Advanced Biometry (4)
BIOL 5167 - Medical Genetics (3)
BIOL 5171 - Cell Physiology (3)
BIOL 5189 - Mechanisms in Development (3)
BIOL 5199 - Molecular Biology (3)
BIOL 5233 - Parasitology (3)
BIOL 5235 - Mammalogy (4)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5251 - Immunology (3)
BIOL 5251L - Immunology Laboratory (1)
BIOL 5254 - Epidemiology (3)
BIOL 5256 - Pathogenic Bacteriology (3)
BIOL 5256L - Pathogenic Bacteriology Laboratory (1)
BIOL 5257 - Microbial Physiology and Metabolism (3)
BIOL 5258 - Epidemics and Plagues (3)
BIOL 5259 - Advanced Virology (3)
BIOL 5259L - Advanced Virology Laboratory (1)
BIOL 5265 - Drugs: Molecular and Cellular Mechanisms (3)
BIOL 5277 - Endocrinology (3)
BIOL 5279 - Neurobiology (3)
BIOL 5283 - Developmental Biology (3)
BIOL 5283L - Developmental Biology Laboratory (1)
BIOL 5292 - Advances in Immunology (3)
BIOL 5293 - Comparative Vertebrate Anatomy (4)
BIOL 6000 - Special Topics in Biology (1 to 4) *(Cancer Genetics, Cancer Progression and Metastasis, and Carcinogenesis and Immunity topics)*
BIOL 6010 - Special Topics in Microbiology (1 to 4)
BIOL 6101 - Hypothesis Testing (3)
BIOL 6102 - Cell and Molecular Biology (3)
BIOL 6103 - Immunology of Infection (4)
BIOL 6104 - Integrative Systems Physiology (4)
BIOL 6270 - Biological Pathways and Metabolism (3)
BIOL 6273 - Advanced Human Physiology (3)
BIOL 6274 - Advanced Human Pathophysiology (3)
BIOL 6901 - Laboratory Research (1 to 2)

Certificate Total = 15 Credit Hours

Grade Requirements

The Certificate in Biomedical Sciences is awarded upon completion of the courses for 15 or more credit hours, with a cumulative GPA of 3.0 or higher. Only one grade of C may be counted toward the certificate.

Requests for related courses and substitutions may be approved at the discretion of the Certificate Director and Graduate Program Director and Coordinator.

Graduate Certificate in Biotechnology

The Graduate Certificate in Biotechnology offered by the Department of Biological Sciences is a multi-disciplinary program designed to combine advanced discipline-specific coursework with activities that develop those communication and technical skills that are highly valued by employers in the biotechnology industry. Successful completion of the certificate program provides students with a solid foundation for success through practical experience gained via internships in laboratories on campus or in local industry. The certificate program also cultivates an awareness of ethical, policy, and

management issues related to the biotechnology industry. The faculty and staff of the certificate program assist students toward achieving their greatest academic, personal, and professional potential through quality courses and instruction. In addition, the certificate program helps meet the employment needs of biotechnology laboratories and provide quality continuing education to laboratory professionals in our service area.

Admission Requirements

- A bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
- Evidence of sufficient undergraduate preparation in biology with a minimum of 12 credit hours in biology
- A minimum of 12 credit hours of related study (preferably at least one semester of Organic Chemistry and one semester of Statistics)
- GPA of at least 2.8 (based on a 4.0 scale) on all previous complete work beyond high school (secondary school)
- An online application through the Graduate School's application system
- A statement of purpose
- Unofficial transcripts of all college coursework attempted
- Official and satisfactory scores on the Test of English as a Foreign Language Test (TOEFL) or the International English Language Testing System (IELTS), if English is not the applicant's native language and if the applicant has not earned a post-secondary degree from a U.S. institution

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Certificate Requirements

The Graduate Certificate in Biotechnology requires 15 credit hours of courses that must be completed within four years of study starting from the time the first course is taken. Courses taken for one graduate certificate may not be counted toward another graduate certificate. Up to 6 credit hours of graduate coursework taken as post-baccalaureate status at UNC Charlotte may be applied toward the certificate. Credit hours earned in the certificate program may be applied to the master's or doctoral program in Biology pursued either in conjunction with or after the certificate has been awarded subject to admission to that graduate program. Requests for related courses and substitutions may be approved at the discretion of the Certificate Director and Graduate Program Director and Coordinator.

Biological Sciences Courses (9 credit hours)

Select from the following:

BIOL 5162 - Advanced Biotechnology I (3)
BIOL 5163 - Advanced Biotechnology II (3)
BIOL 5167 - Medical Genetics (3)
BIOL 5168 - Recombinant DNA Techniques (4)
BIOL 5171 - Cell Physiology (3)
BIOL 5184 - Plant Biotechnology (3)
BIOL 5250 - Microbiology (3)
BIOL 5250L - Microbiology Laboratory (1)
BIOL 5251 - Immunology (3)
BIOL 5253 - Marine Microbiology (4)
BIOL 5254 - Epidemiology (3)
BIOL 5255 - Bacterial Genetics (3)
BIOL 5256 - Pathogenic Bacteriology (3)
BIOL 5256L - Pathogenic Bacteriology Laboratory (1)
BIOL 5259 - Advanced Virology (3)
BIOL 5259L - Advanced Virology Laboratory (1)
BIOL 5265 - Drugs: Molecular and Cellular Mechanisms (3)
BIOL 5292 - Advances in Immunology (3)
BIOL 6101 - Hypothesis Testing (3)
BIOL 6241 - Environmental Biology (3)
BIOL 6270 - Biological Pathways and Metabolism (3)
BIOL 6366 - Advanced Protein Biotechnology (3)

Bioinformatics and Chemistry Courses (3 credit hours)

Select from the following:

BINF 5171 - Business of Biotechnology (3)
BINF 5191 - Life Sciences and the Law (3)
BINF 6200 - Statistics for Bioinformatics (3)
BINF 6201 - Molecular Sequence Analysis (3)
BINF 6203 - Genomics (3)
CHEM 5090 - Special Topics in Chemistry (1 to 4) (NanoBiochemistry)

Seminar Course (1 credit hour)

BIOL 6600 - Seminar (1 to 2)

Research Internship (2 credit hours)

Participate in 2 credit hours of a biotechnology-based research internship:

BIOL 6901 - Laboratory Research (1 to 2)

Certificate Total = 15 Credit Hours

Grade Requirements

A minimum cumulative GPA of 3.0 in all courses is required. Only one grade of C may be counted toward the certificate.

CHEMISTRY

- M.S. in Chemistry
- Ph.D. in Nanoscale Science *(see individual Nanoscale Science section)*

Department of Chemistry
chemistry.charlotte.edu

M.S. in Chemistry

The Department of Chemistry offers a research-based Master of Science (M.S.) degree, which provides the background necessary for further graduate or professional studies in the physical, life or medical sciences or a career in chemistry. The M.S. degree requires a minimum of 30 credit hours and a thesis based on original research carried out under the direction of a member of the graduate faculty. Student participation in research activities is through selection of a faculty advisor and enrollment in the special research courses offered. Major emphasis is placed upon the research project and required thesis. UNC Charlotte B.S. degree chemistry majors may elect to participate in the five-year Accelerated Early Entry M.S. program (described in the *UNC Charlotte Undergraduate Catalog).*

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Chemistry:

1) Administration of placement examinations by the department each semester just prior to registration as an aid in identifying academic deficiencies
2) Removal of any deficiencies within one year
3) International students must meet published University standards on English proficiency

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
Students in this program must complete a minimum of 30 credit hours, including at least 15 credit hours in 6000-level courses open to graduate students only.

Students in the M.S. in Chemistry program are required to be non-deficient in four out of five sub-disciplines of chemistry (inorganic chemistry, organic chemistry, physical chemistry, biochemistry, instrumental/analytical chemistry) as determined by five placement exams prior to the beginning of classes during the first enrolled semester. Students must not be deficient in organic chemistry, physical chemistry, and two other sub-disciplines of their choice. Deficiencies may be removed by passing the placement exam at the beginning of the subsequent semester or by passing a graduate level course with a grade B or above.

To obtain the required 30 credit hours for graduation, students may choose additional credit hours in Research and Thesis or Elective Courses.

All courses must be taken within seven years of admission to the program.

Required Courses
CHEM 6681 - Research Seminar (1)
CHEM 6682 - Research Seminar (1)
CHEM 6900 - Research and Thesis (1 to 16)

Elective Courses
Select 6 credit hours from the following:
CHEM 6060 - Special Topics and Investigations (1 to 3)*
CHEM 6069 - Topics in Biochemistry (3)
CHEM 6082 - Surfaces and Interfaces of Materials Chemistry (3)
CHEM 6101 - Biochemical Principles (4)
CHEM 6115 - Advanced Analytical Chemistry (3)
CHEM 6125 - Theoretical Inorganic Chemistry (3)
CHEM 6126 - Organometallic Chemistry (3)
CHEM 6135 - Advanced Organic Chemistry (3)
CHEM 6138 - Stereochemistry (3)
CHEM 6145 - Chemical Thermodynamics (3)
CHEM 6146 - Rates and Mechanisms (3)
CHEM 6147 - Molecular Photochemistry and Photophysics (3)
CHEM 6150 - Seminar-Internship (1 to 3)
CHEM 6155 - Polymer Synthesis (3)
CHEM 6165 - Advanced Biochemistry (3)
CHEM 6900 - Research and Thesis (1 to 16)
MEGR 6109 - Biotechnology and Bioengineering (3)
Another course that has been approved by the Department of Chemistry faculty**

**Departmental approval is necessary before CHEM 6060 credit can be used to satisfy this requirement.*

***Any 5000 level or higher Biology, Engineering, Mathematics or Physics course, except those designed for a professional education sequence, may be taken for graduate credit upon departmental approval.*

Thesis
A thesis must be written and defended within seven calendar years after admission into the M.S. program as a degree student.

The written thesis is defended before the department and a special thesis committee of no fewer than four persons, with at least one member from outside of the Department of Chemistry.

Degree Total = 30 Credit Hours

Grade Requirements
Students in the M.S. in Chemistry program are required to maintain satisfactory progress toward the degree. Continued enrollment is at all times subject to review on the basis of academic record. This review is performed by the departmental Graduate Committee.

A GPA of 3.0 is required for the degree. An accumulation of two marginal (C) grades or one unsatisfactory (U) grade on the graduate transcript results in termination of the student's enrollment in the M.S. in Chemistry program and a termination of any assistantships and fellowships they were receiving.

Advising
Approval of the program of each student and monitoring their progress toward the degree is the responsibility of the student's research advisor. Prior to the selection of a research advisor, graduate student progress is monitored by the departmental Graduate Committee.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Research Experiences
Chemistry faculty offer research opportunities in all areas of molecular and nanoscale sciences, and many participate in formal or informal interdisciplinary research programs. Faculty research interests include computational chemistry, organic synthesis, polymer chemistry, organometallic chemistry, structural and mechanistic organic chemistry, electrochemistry, materials and interfacial chemistry, catalysis, biochemistry, biophysical chemistry, analytical separations, bioanalytical chemistry, mass spectrometry, and chemical education. Many chemistry faculty are active participants in interdisciplinary research projects in biotechnology and biomedicine, optical science, materials science, or electrical engineering. Students receive academic credit for their research and benefit from a low student-to-faculty ratio. Graduate students are assigned individual projects and work closely with faculty members to build their own, original contribution to the scientific literature. Students have full access to and receive excellent training in the use of any departmental instrumentation needed to carry out their research. Results are presented at informal seminars, scientific conferences, and in articles published in high-quality, refereed journals. Research in the Department is funded in part from competitive grants obtained from agencies such as the American Chemical Society, National Science Foundation, National Institutes of Health, DoD, DoE, Research Corporation, Dreyfus Foundation, North Carolina Biotechnology Center, UNC Charlotte Foundation, and private industry.

Assistantships
Graduate students generally support their education through teaching or research assistantships available through the Department of Chemistry. The department also sponsors the Gary Howard Research Fellowship competition, which provides significantly greater support to one highly qualified applicant. Tuition waivers covering state tuition are also available to external applicants through the Thomas Walsh Tuition Fellowships. Many faculty may offer research assistantships to qualified students Further information is available in the department. Support in the summer months may also available.

Tuition Waivers
Fellowships are available for students enrolled in the M.S. in Chemistry program and for students seeking an interdisciplinary doctoral degree through the Department of Chemistry. Further information is available in the department.

COGNITIVE SCIENCE

- Graduate Certificate in Cognitive Science

Graduate Program
cognisci.charlotte.edu

Graduate Certificate in Cognitive Science

The Graduate Certificate in Cognitive Science offers graduate students an opportunity for an interdisciplinary program of study. Training focuses on an understanding of human cognitive processes and the means by which complex mental processes can be modeled or simulated by artificial systems. Cognitive science is a dynamic and rapidly evolving field that studies intelligent systems by synthesizing the knowledge and methodology from the fields of cognitive psychology, artificial intelligence, linguistics, philosophy of mind and cognitive neuroscience. Students are provided with the conceptual framework and the technical skills necessary to enhance careers in research, teaching, business or government. Students completing the program add an interdisciplinary perspective to the training received in their major, better preparing them for employment or further study in a variety of sciences and social sciences. The certificate may be pursued as a stand-alone program or concurrently with another graduate degree program at UNC Charlotte.

Admission Requirements
The certificate program is open to all students who hold a bachelor's degree from a college or university accredited by an accepted accrediting body and either:

a) are enrolled and in good standing in a graduate degree program at UNC Charlotte, or
b) have a minimum GPA of 3.0 for their undergraduate courses.

Application for the Cognitive Science Certificate Program is made through the Office of Graduate Admissions.

Certificate Requirements
The Graduate Certificate in Cognitive Science Program involves 15 credit hours of coursework. Students must take the required introductory course and at least two of the disciplinary courses. The remaining hours may come from any of the other topics courses listed.

Required Course
Select one of the following:
PSYC 6216 - Introduction to Cognitive Science (3)
ITCS 6216 - Introduction to Cognitive Science (3)
ITIS 6216 - Introduction to Cognitive Science (3)

Disciplinary Courses
Select at least two of the following:
PSYC 6116 - Cognition (3)
ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)
ITCS 6150 - Intelligent Systems (3)
PHIL 6340 - Philosophy of Mind (3)

Elective Courses
PSYC 5316 - Cognitive Neuroscience (3)
PSYC 6015 - Topics in Perception and Physiological Psychology (3)
PSYC 6102 - Organizational Research Methods (3)
PSYC 6115 - Sensation and Perception (3)
ITCS 5152 - Computer Vision (3)
ITCS 6151 - Intelligent Robotics (3)
ITCS 6153 - Neural Networks (3)
ITCS 6156 - Machine Learning (3)
ITCS 6158 - Natural Language Processing (3)
ITCS 6159 - Intelligent Tutoring (3)
or ITCS 8159 - Intelligent Tutoring (3)
ITCS 6170 - Logic for AI (3)
ITIS 6400 - Principles of Human Computer Interaction (3)
or ITIS 8400 - Principles of Human Computer Interaction (3)
ITIS 6510 - Software Agent Systems (3)
or ITIS 8510 - Software Agent Systems (3)
ITCS 6500 - Complex Adaptive Systems (3)
or ITCS 8500 - Complex Adaptive Systems (3)
or ITIS 6500 - Complex Adaptive Systems (3)
or ITIS 8500 - Complex Adaptive Systems (3)
ECGR 5196 - Introduction to Robotics (3)
ECGR 6102 - Optimization of Engineering Designs (3)
ECGR 6266 - Neural Networks Theory and Design (3)
ECGR 8266 - Neural Networks Theory and Design (3)
CEGR 5181 - Human Factors in Traffic Engineering (3)
Topics, seminars, or other courses in the cognitive sciences approved by the Graduate Program Director

Certificate Total = 15 Credit Hours

Grade Requirements
A cumulative GPA of 3.0 is required and at most one course with a grade of C may be allowed toward the certificate.

COMMUNICATION STUDIES

- M.A. in Communication Studies

Department of Communication Studies
gradcomm.charlotte.edu

M.A. in Communication Studies

The Master of Arts in Communication Studies is designed to provide advanced study in the communication discipline, particularly in the areas of organizational communication, critical media and rhetorical studies, health communication, and public relations. All studies emphasize the ability to understand and analyze communication practices in different environments in the 21st Century. The curriculum is broad-based and is a balance of theory and application to practice.

Admission Requirements
At minimum, students must:

- Meet all of the Graduate School requirements
- Submit three letters of recommendation
- Submit a strong personal essay outlining their reasons for pursuing a master's degree
- Submit an academic writing sample

The department does allow students to take up to six (6) credit hours as a post-baccalaureate student; students must follow the Graduate School guidelines for application for this status. Students are encouraged to meet with the Graduate Program Director as soon as possible after registering as a post-baccalaureate student to discuss application procedures and program options.

GRE Waiver
The GRE score requirement is waived for all applicants to the M.A. in Communication Studies program.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
The Master of Arts degree program requires the completion of thirty (30) credit hours of graduate work. All students, regardless of orientation and area of study, must complete four (4) core courses. All students writing a thesis or a directed project earn their final six (6) credit hours with research-based activities. No more than six (6) credit hours may be taken at 5000 level. All courses must be taken within seven years after admission into the Communication Studies master's program.

Core Courses (12 credit hours)
COMM 6011 - Topics in Communication Research Methods (3)
COMM 6100 - Communication Research Methods (3)
COMM 6101 - Contemporary Viewpoints in Communication Theory (3)
COMM 6102 - Professional Seminar in Communication Studies (3)

Interest Areas
The graduate program is a generalist program, in that students don't specialize in any one area but instead take courses through many of the interest areas. Faculty teach and conduct research across the following interest areas:

Organizational Communication
Organizational communication focuses on the various ways individuals influence and are influenced by organizations and their members. Work in organizational communication is concerned with organizational culture and symbolism, interpersonal and group communication, change communication, globalization, mediated communication, leader communication, structural concerns of organizational communication, and critical analysis of organizational communication.

Rhetoric/Media Studies/Popular Culture
Graduate study of the mass media at UNC Charlotte concentrates on applied and critical research on the organization and effects of media industries and new media technologies. Areas of study include persuasion and popular culture, computer-mediated persuasion, computer-mediated communication, and the rhetoric of spectator sport.

Health Communication
Health communication is a field of study offering students a better understanding of the communication within a health context. This includes, but is not limited to, provider-patient interaction; the creation, promotion, and influence of health information; social and community health issues; healthcare organizations; media messages about health; and interpersonal health communication.

Public Relations/International Public Relations
The focus of public relations is on building and maintaining internal and external relationships with entities essential to an organization's success, including entities such as media,

activist groups, community groups, and regulators. The focus of UNC Charlotte's program is on public relations management, especially in the areas of issues tracking, corporate communication, crisis communication, not-for-profit communication, and international public relations efforts.

Capstone Experience (6 credit hours)

Students choose among three (3) options for their capstone experience: writing a thesis (6 credit hours); designing and conducting a directed project (6 credit hours); or taking the comprehensive examination (0 credit hours).

Thesis

A thesis is a written research document incorporating original research in a student's area of interest. Students select a thesis committee chair and two committee members and submit a proposal to them. The written thesis is defended before the thesis chair and committee members in the semester the student graduates. A thesis must be written and defended within seven (7) calendar years after admission into the Communication Studies master's program.

Directed Project

A directed project is an applied research document involving research and application to a real world problem or opportunity. Students select a directed project chair and two committee members and submit a project to them. The completed project is presented to the directed project chair and committee members in the semester the student graduates. A directed project must be successfully completed and presented within seven (7) calendar years after admission into the Communication Studies master's program.

Comprehensive Examination

The comprehensive examination is a nine-hour, written examination and oral defense covering communication theory, communication research methods, and a third comprehensive area each student designates as their specialty area of study in communication. Students opting to take the comprehensive examination should indicate their intention to the Graduate Program Director in the semester previous to the one in which they plan to sit for the examination. The examination itself carries no credit hours; students selecting this option must take six (6) additional credit hours to reach the thirty (30) hour credit requirement. The comprehensive examination must be successfully completed within the seven (7) year master's time limit for degree completion.

Degree Total = 30 Credit Hours

Grade Requirements

Successful completion of the degree requires a minimum GPA of 3.0.

Advising

Upon formal acceptance, all graduate students must meet with the Graduate Program Director to file a proposed plan of study in the department and become familiar with the department's expectations. As students progress through their program of study, the Graduate Program Director will assist them in selecting a suitable advisor and committee members for the thesis, directed project, or comprehensive examination options.

Application for Degree

Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Assistantships

The Department has regular research/teaching assistantships available on a competitive basis to qualified students. Students will automatically be considered for an assistantship as part of the regular application process.

CRIMINAL JUSTICE

- M.S. in Criminal Justice
- Graduate Certificate in Crime Analysis

Department of Criminal Justice and Criminology
criminaljustice.charlotte.edu

M.S. in Criminal Justice

The Master of Science (M.S.) in Criminal Justice degree program is designed to promote broad based study of the phenomenon of crime and to enhance career opportunities in the field of criminal justice. The program utilizes the social and behavioral sciences in an interdisciplinary approach to study law, crime, and social deviance, and to examine critically the systems created in response to deviance and crime. The objectives of the program are to: (1) provide present and future criminal justice personnel with the educational background necessary to function effectively in the dynamic field of criminal justice; (2) familiarize students with the nature, methods, and functions of research, and with the existing body of knowledge on criminal justice; (3) provide the criminal justice system with qualified candidates for careers in the field; and (4) prepare students for entrance into doctoral programs. Career opportunities available in the criminal justice system include law enforcement, corrections, administration, planning and analysis, juvenile justice, and college instruction. There are also private sector careers available, including private security and loss prevention. Students may enroll in the program on either a full-time or part-time basis. Many classes are scheduled in the evening to accommodate the part-time student. Full-time students can complete the program over a 12-month period.

Admission Requirements
Admission to the Criminal Justice graduate program is open to students with bachelor's degrees in any discipline who meet the general requirements for admission to the Graduate School. Preference is given to applicants who have a grade point average of at least 3.0, a satisfactory score on the Graduate Record Examination (GRE) (above 300 on the combined verbal and quantitative sections), a personal statement describing their interest in attaining the degree, and three strong recommendation letters from those who are able to attest to your academic ability.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
A minimum of 31 credit hours is required.

Core Courses (16 credit hours)
Students must complete each of the following six core courses with a grade of B or above:

CJUS 6101 - The Nature and Theory of Crime (3)
CJUS 6102 - Research in Criminal Justice I (3)
CJUS 6103 - Research in Criminal Justice II (3)
CJUS 6104 - Criminal Justice and Social Control (3)
CJUS 6105 - Criminal Justice Seminar (1)
CJUS 6106 - Introduction to Crime Analytics and Informatics (3)

Elective Courses (15 credit hours)
The elective credit hours may come from any 5000- or 6000-level course offered within the Department of Criminal Justice and Criminology. A maximum of 9 elective credit hours may be taken outside the Department of Criminal Justice and Criminology (with approval of the Graduate Program Director).

CJUS 5XXX-6XXX - Criminal Justice and Criminology Elective (3)
CJUS 5XXX-6XXX - Criminal Justice and Criminology Elective (3)
CJUS 5XXX-6XXX - Criminal Justice and Criminology Elective (3)
CJUS 5XXX-6XXX - Criminal Justice and Criminology Elective (3)
CJUS 5XXX-6XXX - Criminal Justice and Criminology Elective (3)

Thesis
Students who choose to write a thesis are required to complete 3 credit hours each of the following courses. These credit hours become part of the 15 elective credit hours students must complete.

CJUS 6901 - Thesis I (3)
CJUS 6902 - Thesis II (1 to 3)

Transfer Courses
A maximum of six elective credit hours with grades of B or above may be transferred from another institution. Transfer courses must be consistent with the program and will be accepted at the discretion of the department. At least 25 credit hours must be taken in residence. To complete the program, students have the option of taking a comprehensive examination or writing a thesis.

Degree Total = 31 Credit Hours

Assistantships
The Department of Criminal Justice and Criminology offers graduate assistantships which are awarded primarily on the basis of academic merit.

Financial Aid
In addition to the graduate assistantships, the department offers, as available, research assistantships and grant-funded opportunities for students. In addition, a few scholarships are available each year.

Comprehensive Examination
The comprehensive examination is offered each Fall and Spring semester, as well as in the Summer. The comprehensive examination may be taken no more than two times. Students who fail to pass the comprehensive examination on their second attempt will be terminated from the program.

Graduate Certificate in Crime Analysis

The graduate certificate in Crime Analysis provides students with exposure to practical skills and theoretical insight into understanding crime patterns. The certificate also provides exposure to the ethical issues surrounding data management and analysis. The certificate includes courses aimed at providing students with a marketable skill set.

Admission Requirements
- A bachelor's degree from a college or university accredited by an accepted accrediting body
- Application to the Graduate Admissions portal accompanied by the application fee in effect
- A GPA of at least 2.75
- Unofficial transcripts
- Statement of purpose

Certificate Requirements
The certificate is awarded upon successful completion of 12 credit hours earned in courses. Students may apply credit hours earned in this certificate program toward the M.S. in Criminal Justice program. Requests for related courses and substitutions may be approved at the discretion of the Graduate Program Director. Up to 6 hours of post-baccalaureate status may be applied to the certificate with the approval of the Graduate Program Director. All coursework applied to a certificate must be completed within 5 years.

Required Courses (6 credit hours)
CJUS 6104 - Legal and Ethical Issues in Crime Analysis (3)
CJUS 6106 - Introduction to Crime Analytics and Informatics (3)

Elective Courses (6 credit hours)
Select two of the following:
CJUS 6102 - Research Methods and Design (3)
CJUS 6103 - Introduction to Data Analysis (3)
CJUS 6171 - Geospatial Analytics and Crime (3)
CJUS 6172 - Intelligence Analysis (3)
CJUS 6174 - Data Visualization (3)

Certificate Total = 12 Credit Hours

Grade Requirements
Students must earn a B or above in all courses toward the certificate.

ENGLISH

- M.A. in English
  - Applied Linguistics
  - Children's Literature
  - Composition/Rhetoric
  - Creative Writing
  - English Education
  - English for Specific Purposes
  - Literature
  - Technical/Professional Writing
- M.A. in English/M.F.A. in Creative Writing Dual Degree
- Graduate Certificate in Applied Linguistics
- Graduate Certificate in Technical/Professional Writing

Department of English
english.charlotte.edu

M.A. in English

The Master of Arts in English degree program is designed to accommodate a wide variety of students: those seeking personal enrichment through increased knowledge and understanding; those preparing to pursue a Ph.D. in English or other advanced professional degrees; and those seeking professional advancement in such fields as writing, publishing, or teaching on the primary, secondary, or college levels. There are eight concentrations available within the M.A. in English. Additionally, the Department of English offers a broad range of courses in literature, composition/rhetoric, and language, including second language studies and applied linguistics.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for study in English:

1) 30 credit hours of undergraduate coursework in English beyond the first-year level, or evidence of equivalent academic preparation for graduate study in English, as approved by the department.
- A writing sample of 6-10 pages, which must be an example of analytical, scholarly writing (rather than creative writing) in any area of English studies. Students may submit an excerpt from a longer work with a short prefatory paragraph offering a description or introduction to the selection. Students who have been out of school for an extended period and do not have a scholarly writing sample should contact the Director of Graduate Studies about an alternative way to meet this requirement.

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
The program requires a minimum of 36 credit hours. Students must select a concentration from the following options:

1) Applied Linguistics
2) Children's Literature
3) Composition/Rhetoric
4) Creative Writing
5) English Education
6) English for Specific Purposes
7) Literature
8) Technical/Professional Writing

For all students except those in the English Education concentration, of the 36 hours of graduate credit, 30 must be in English courses; the remaining 6 credit hours may be taken in English or in another discipline. If the credit hours are to be taken outside of English, students must submit a written request to the Graduate Program Director, explaining how these credit hours will enrich their program. Additionally, at least 18 credit hours must be in English courses at the 6000 level, open only to graduate students.

For students in the English Education concentration, all 36 credit hours must be taken in English or the College of Education. Additionally, at least 18 credit hours must be in English or College of Education courses at the 6000 level, open only to graduate students.

Courses beyond 36 hours of graduate credit may be required to remove deficiencies or to satisfy requirements for graduate licensure, or may be recommended to develop areas of need, to pursue particular interests, or to gain specific experience.

No more than 6 credit hours of ENGL 6890 (Directed Reading), may be applied to the degree without written permission of the Department Chair.

Concentrations

Applied Linguistics Concentration

Linguistics is a broad field, and the applied linguistics concentration offers students the opportunity to apply linguistic concepts to a broad range of endeavors, including the teaching of writing, adult English language instruction, and various types of textual analyses.

Core Courses (6 credit hours)

ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Required Courses (9 credit hours)

ENGL 6127 - Seminar in Language, Culture and Society (3)
ENGL 6161 - Introduction to Linguistics (3)
ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)

Elective Linguistics Courses (6 credit hours)

Select two of the following:

ENGL 5075 - Topics in Linguistics (3)
ENGL 5161 - Modern English Grammar (3)
ENGL 5165 - Multiculturalism and Language (3)
ENGL 5166 - Comparative Language Studies for Teachers (3)
ENGL 5167 - The Mind and Language (3)
ENGL 5254 - Teaching English/Communications Skills to Middle and Secondary School Learners (3)
ENGL 5260 - History of Global Englishes (3)
ENGL 5262 - Language and Diversity (3)
ENGL 5263 - Linguistics and Language Learning (3)
ENGL 5272 - Studies in the Politics of Language and Writing (3)
ENGL 6070 - Topics in English (3) *(Linguistics topic; must be approved by the English Graduate Program Director)*
ENGL 6162 - History of the English Language (3)
ENGL 6164 - Comparative Language Analysis for Teachers (3)
ENGL 6165 - Introduction to English for Specific Purposes (3)
ENGL 6167 - Research Methods in Applied Linguistics (3)
ENGL 6168 - Practicum in English for Specific Purposes (3)

Elective Literature Courses (6 credit hours)

Select two of the following:

ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5090 - Major Authors (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)
ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5251 - Literary Criticism Through Arnold (3)
ENGL 5252 - Modern Literary Criticism (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6070 - Topics in English (3) *(Literature topic)*
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6102 - Literary Theory (3)
ENGL 6103 - Introduction to Children's Literature and Culture (3)
ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Elective Writing/Rhetoric Courses (6 credit hours)

Select two of the following:

ENGL 5008 - Topics in Advanced Technical Communication (3)
ENGL 5050 - Topics in English (3) *(Writing topic)*
ENGL 5180 - Theories of Technical Communication (3)
ENGL 5181 - Writing and Designing User Documents (3)
ENGL 5182 - Information Design and Digital Publishing (3)
ENGL 5183 - Editing with Digital Technologies (3)
ENGL 5200 - Teaching of Writing (3)
ENGL 5202 - Writing Poetry (3)
ENGL 5203 - Writing Fiction (3)
ENGL 5204 - Expository Writing (3)
ENGL 5205 - Advanced Expository Writing (3)
ENGL 5206 - Writing Creative Nonfiction (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5208 - Poetry Writing Workshop (3)
ENGL 5209 - Fiction Writing Workshop (3)
ENGL 5235 - History of the Book (3)
ENGL 5264 - Literacy in Family and Community (3)
ENGL 5270 - Studies in Writing, Rhetoric, and Literacy (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5277 - Digital Literacies (3)
ENGL 5280 - Writing About Place (3)
ENGL 5290 - Advanced Creative Project (3)
ENGL 5400 - Research, Theory, and Practice of Tutoring Writing (3)
ENGL 6008 - Topics in Advanced Technical Communication (3)
ENGL 6062 - Topics in Rhetoric (3)
ENGL 6070 - Topics in English (3) *(Writing topic)*
ENGL 6073 - Topics in Creative Writing (3)
ENGL 6116 - Technical/Professional Writing (3)
ENGL 6166 - Rhetorical Theory (3)
ENGL 6181 - Composition Theory and Pedagogy (3)
ENGL 6182 - Research Theory and Method in Rhetoric and Composition (3)
ENGL 6183 - Critical Pedagogy and the Teaching of Writing (3)
ENGL 6195 - Teaching College English (3)

Project/Thesis (3-6 credit hours)

All students in the Applied Linguistics concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project

Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 Project (3)

Master's Thesis

The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers. Since the thesis carries 6 credit hours, students electing the thesis option will take only one course from the Elective Linguistics Courses listed above.

ENGL 6996 Thesis (6)

Children's Literature Concentration

This concentration is premised on the assumptions that children's literature is an integral part of many literary traditions and that students studying children's literature should develop an understanding of the connection between children's literature and other forms of literature. The Children's Literature Concentration requires a total of 36 credit hours.

Core Courses (6 credit hours)

ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Introductory Course (3 credit hours)

ENGL 6103 - Introduction to Children's Literature and Culture (3)

Elective Children's Literature Courses (12 credit hours)

Select four of the following:

ENGL 5050 - Topics in English *(topics that relate to Children's Literature)* (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 6070 - Topics in English *(topics that relate to Children's Literature)* (3)
ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6890 - Directed Reading (3)
ENGL 6996 - Thesis (6)
EDUC 5000 - Topics in Education *(topics that relate to Children's Literature)* (3)
READ 6100 - Current Issues and Practices in Literacy (3)

Elective Literature Courses (6 credit hours)

Select two of the following literature courses (that aren't children's literature):

ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5090 - Major Authors (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)

ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5251 - Literary Criticism Through Arnold (3)
ENGL 5252 - Modern Literary Criticism (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6102 - Literary Theory (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Elective Writing/Rhetoric Course (3 credit hours)

Select one of the following:

ENGL 5008 - Topics in Advanced Technical Communication (3)
ENGL 5050 - Topics in English (3) *(Writing topic)*
ENGL 5180 - Theories of Technical Communication (3)
ENGL 5181 - Writing and Designing User Documents (3)
ENGL 5182 - Information Design and Digital Publishing (3)
ENGL 5183 - Editing with Digital Technologies (3)
ENGL 5200 - Teaching of Writing (3)
ENGL 5202 - Writing Poetry (3)
ENGL 5203 - Writing Fiction (3)
ENGL 5204 - Expository Writing (3)
ENGL 5205 - Advanced Expository Writing (3)
ENGL 5206 - Writing Creative Nonfiction (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5208 - Poetry Writing Workshop (3)
ENGL 5209 - Fiction Writing Workshop (3)
ENGL 5235 - History of the Book (3)
ENGL 5264 - Literacy in Family and Community (3)
ENGL 5270 - Studies in Writing, Rhetoric, and Literacy (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5277 - Digital Literacies (3)
ENGL 5280 - Writing About Place (3)
ENGL 5290 - Advanced Creative Project (3)
ENGL 5400 - Research, Theory, and Practice of Tutoring Writing (3)
ENGL 6008 - Topics in Advanced Technical Communication (3)
ENGL 6062 - Topics in Rhetoric (3)
ENGL 6070 - Topics in English (3) *(Writing topic)*
ENGL 6073 - Topics in Creative Writing (3)
ENGL 6116 - Technical/Professional Writing (3)
ENGL 6166 - Rhetorical Theory (3)
ENGL 6181 - Composition Theory and Pedagogy (3)
ENGL 6182 - Research Theory and Method in Rhetoric and Composition (3)
ENGL 6183 - Critical Pedagogy and the Teaching of Writing (3)
ENGL 6195 - Teaching College English (3)

Comprehensive Examination/Thesis (0-6 credit hours)

All students in the children's literature concentration must satisfactorily complete either a written examination or a Master's thesis.

Comprehensive Examination

Students electing this option must satisfactorily complete a written examination based on a reading list proposed by the student and approved by The English Graduate Committee. Information about this list is available in the Department of English office. The written examination may not be attempted sooner than the last semester of coursework, exclusive of thesis credits.

Master's Thesis

The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers. Students electing the thesis option receive six credit hours that replace the unrestricted elective course and another course as approved by the

English Graduate Program Director.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (0-6 credit hours)
Students who elect the Comprehensive Examination option above select two additional elective courses. Students who elect the Thesis option above are not required to take any additional elective courses. Elective courses require approval of the English Graduate Program Director.

Composition/Rhetoric Concentration

The field of rhetoric and composition prepares students comprehensively in the theory, practice, and teaching of written public discourse. The program introduces research in the language arts, from the ancient rhetoric of Greece and Rome to modern theories of the composing process, while also emphasizing practical preparation in the teaching of writing and the administration of composition programs, writing centers, and writing across the curriculum programs. The Composition/Rhetoric concentration may focus on rhetorical theory, composition theory, or writing and pedagogy.

Core Courses (6 credit hours)
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Elective Writing Theory Intensive Course (3 credit hours)
Select one of the following:
ENGL 6166 - Rhetorical Theory (3)
or another course approved by the English Graduate Program Director

Elective Literature Courses (6 credit hours)
Select two of the following:
ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5090 - Major Authors (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)
ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5251 - Literary Criticism Through Arnold (3)
ENGL 5252 - Modern Literary Criticism (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6102 - Literary Theory (3)
ENGL 6103 - Introduction to Children's Literature and Culture (3)
ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Elective Composition/Rhetoric Courses (12 credit hours)
Select four of the following:
ENGL 5050 - Topics in English (3) *(Writing topic)*
ENGL 5200 - Teaching of Writing (3)
ENGL 5204 - Expository Writing (3)
ENGL 5205 - Advanced Expository Writing (3)
ENGL 5264 - Literacy in Family and Community (3)
ENGL 5270 - Studies in Writing, Rhetoric, and Literacy (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5272 - Studies in the Politics of Language and

Writing (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5277 - Digital Literacies (3)
ENGL 5400 - Research, Theory, and Practice of Tutoring Writing (3)
ENGL 6062 - Topics in Rhetoric (3)
ENGL 6070 - Topics in English (3) *(Writing topic)*
ENGL 6166 - Rhetorical Theory (3)
ENGL 6181 - Composition Theory and Pedagogy (3)
ENGL 6182 - Research Theory and Method in Rhetoric and Composition (3)
ENGL 6183 - Critical Pedagogy and the Teaching of Writing (3)
ENGL 6195 - Teaching College English (3)

Project/Thesis (3-6 credit hours)
All students in the Composition/Rhetoric concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project
Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 - Project (3)

Master's Thesis
The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (3-6 credit hours)
Students who elect the Project option above select two additional elective courses. Students who elect the Thesis option above select one additional elective course. Elective courses require approval of the English Graduate Program Director.

Creative Writing Concentration

The aim of this concentration is to enable students to develop their abilities as creative writers through writing practice in more than one genre and through the creatively-engaged study of literature.

Core Courses (6 credit hours)
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Elective Fiction Writing Course (3 credit hours)
Select one of the following:
ENGL 5203 - Writing Fiction (3)
ENGL 5206 - Writing Creative Nonfiction (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5209 - Fiction Writing Workshop (3)
ENGL 5280 - Writing About Place (3)

Elective Poetry Writing Course (3 credit hours)
Select one of the following:
ENGL 5202 - Writing Poetry (3)
ENGL 5208 - Poetry Writing Workshop (3)

Elective Creative Writing Courses (6 credit hours)
ENGL 6073 - Topics in Creative Writing (3)
ENGL 6073 - Topics in Creative Writing (3)

Elective Literature Courses (9 credit hours)
Select three of the following, one of which must be in modern and/or contemporary literature:
ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5090 - Major Authors (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)
ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)

ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5251 - Literary Criticism Through Arnold (3)
ENGL 5252 - Modern Literary Criticism (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6102 - Literary Theory (3)
ENGL 6103 - Introduction to Children's Literature and Culture (3)
ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Project/Thesis (3-6 credit hours)

All students in the Creative Writing concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project

Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 - Project (3)

Master's Thesis

The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (3-6 credit hours)

Students who elect the Project option above select two additional elective courses. Students who elect the Thesis option above select one additional elective course. Elective courses require approval of the English Graduate Program Director.

Elective courses may be additional creative writing courses, if students wish to repeat any of the fiction or poetry courses listed above in order to receive additional instruction in their chosen genre.

English Education Concentration

The Master of Arts in English with a Concentration in English Education has been developed specifically for teachers of the English language arts in middle and secondary schools who desire advanced study in English content and pedagogy, and seek an opportunity to integrate advanced study with their teaching experiences. In addition, candidates acquire the skills, knowledge and abilities required to assume a leadership roles as department chairs, interdisciplinary team leaders, or staff development specialists. Candidates in the program serve as resources for one another and become active members in a community of professionals who are knowledgeable, effective, and committed practitioners. At the conclusion of the program, graduates will be teacher leaders who understand and establish respectful educational environments, demonstrate content and curriculum expertise, effectively support student learning through evidence-based research, and exhibit systematic, critical analysis of learning through purposeful and meaningful reflection.

Program Goals

Successful graduates possess a comprehensive pedagogical, conceptual, and reflective knowledge base that can be applied to their classrooms through effective instruction, responsiveness, and collaboration. Program graduates will be able to:

- Self-direct their personal and professional growth
- Respond effectively to adolescent differences, equity and diversity, and global learning communities
- Demonstrate advanced pedagogical content knowledge of the curriculum, as well as apply 21st knowledge, skills, and technical expertise
- Improve educational practice through critical self-reflection, self-assessment, and applied research
- Work collaboratively with colleagues, professionals, parents, guardians, families and individuals charged with the well being of learners
- Assume a leadership role at the local, district, regional, state, or national level

Additional Admission Requirements

In addition to the general requirements for admission to the Graduate School, applicants must:

- Hold the "A" license in Secondary English or Middle Grades Language Arts from the North Carolina Department of Public Instruction (or its equivalent from another state)
- Have an undergraduate GPA of 2.75 overall and 3.0 in the Junior/Senior years and 30 credit hours of

undergraduate coursework in English beyond the Freshman level, or evidence of equivalent academic preparation

Core Course (3 credit hours)
Select one of the following:
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

English Specialization Requirements (12 credit hours)
Select 12 credit hours of graduate-level ENGL courses selected in consultation with the Graduate Program Director. The program's 12 credit hours of content specialization courses are not free electives, but a planned program of study identified upon the student's enrollment in the program as part of the student's overall professional and program plan. At least 18 credit hours of coursework in the program must be in Department of English or College of Education courses at the 6000 level.

Professional Requirements (12 credit hours)
Required Professional Courses
EDUC 5100 - Diverse Learners (3)
ENGL 6274 - Contexts and Issues in the Teaching of English (3)
or EDUC 6274 - Contexts and Issues in the Teaching of English (3)
MDSK 6260 - Teacher Leadership (3)

Elective Professional Course
For the final three credit hours, select a graduate-level ENGL, MDSK, or EDUC course in consultation with the Graduate Program Director. The program's professional courses are not free electives, but a planned program of study identified upon the student's enrollment in the program as part of the student's overall professional and program plan.

Research Requirements (6 credit hours)
Required Research Course
Select one of the following:
ENGL 6674 - Applied Research Methods in the Teaching of English (3)
EDUC 6674 - Applied Research Methods in the Teaching of English (3)
RSCH 7111 - Qualitative Research Methods (3)
Or another research course approved by the English Graduate Program Director

Elective Research Course
Select 3 credit hours of a graduate-level ENGL, MDSK, or EDUC course in consultation with the Graduate Program Director.

Project/Thesis (3-6 credit hours)
All students in the English Education concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project
Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 - Project (3)

Master's Thesis
The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers. Since the thesis carries 6 credit hours, students electing the thesis option will take only ENGL 6674 or EDUC 6674, not the additional Research Requirements course.

ENGL 6996 - Thesis (6)

Licensure
The M.A. in English with a Concentration in English Education qualifies graduates for the Master's/Advanced Competencies "M" license in English Education.

Program Certifications/Accreditation
The program is accredited by both NCATE and NCDPI.

English for Specific Purposes Concentration

With this concentration, certified English for Specific Purposes (ESP) teachers are prepared to teach adult learners in community colleges, in in-company training courses, and in English language institutes at the university level, both in the U.S. and internationally.

Core Courses (6 credit hours)
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Required Courses (9 credit hours)
ENGL 6165 - Introduction to English for Specific Purposes (3)
ENGL 6168 - Practicum in English for Specific Purposes (3)
ENGL 6167 - Research Methods in Applied Linguistics (3)
or RSCH 6101 - Research Methods (3)
or RSCH 7111 - Qualitative Research Methods (3)
or another research course approved by the English Graduate Program Director

Elective Courses (12 credit hours)
Select four of the following:
ENGL 5075 - Topics in Linguistics (3)

ENGL 5161 - Modern English Grammar (3)
ENGL 5165 - Multiculturalism and Language (3)
ENGL 5166 - Comparative Language Studies for Teachers (3)
ENGL 5167 - The Mind and Language (3)
ENGL 5260 - History of Global Englishes (3)
ENGL 5262 - Language and Diversity (3)
ENGL 5263 - Linguistics and Language Learning (3)
ENGL 5272 - Studies in the Politics of Language and Writing (3)
ENGL 6070 - Topics in English (3) *(Linguistics topic; must be approved by the English Graduate Program Director)*
ENGL 6127 - Seminar in Language, Culture, and Society (3)
ENGL 6161 - Introduction to Linguistics (3)
ENGL 6162 - History of the English Language (3)
ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)
ENGL 6164 - Comparative Language Analysis for Teachers (3)

Project/Thesis (3-6 credit hours)
All students in the English for Specific Purposes concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project
Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 - Project (3)

Master's Thesis
The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (3-6 credit hours)
Students who elect the Project option above select two additional elective courses. Students who elect the Thesis option above select one additional elective course. Elective courses require approval of the English Graduate Program Director.

Literature Concentration

The literature faculty are committed to teaching a variety of national and ethnic literatures in English, including British, American, and Anglophone literatures. The Literature concentration requires a total of 36 credit hours.

Core Courses (6 credit hours)
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Elective Literature Courses (15 credit hours)
Select five of the following, of which three must be historically oriented, three must be in at least two national literatures (American, British, global), and one must be in literature written before 1800:

ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5090 - Major Authors (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)
ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5251 - Literary Criticism Through Arnold (3)
ENGL 5252 - Modern Literary Criticism (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6102 - Literary Theory (3)

ENGL 6103 - Introduction to Children's Literature and Culture (3)
ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6144 - Stylistics (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Elective Literary Theory Intensive Course (3 credit hours)
Select one literary theory intensive course.

Elective Writing/Rhetoric Course (3 credit hours)
Select one of the following:
ENGL 5008 - Topics in Advanced Technical Communication (3)
ENGL 5050 - Topics in English (3) *(Writing topic)*
ENGL 5180 - Theories of Technical Communication (3)
ENGL 5181 - Writing and Designing User Documents (3)
ENGL 5182 - Information Design and Digital Publishing (3)
ENGL 5183 - Editing with Digital Technologies (3)
ENGL 5200 - Teaching of Writing (3)
ENGL 5202 - Writing Poetry (3)
ENGL 5203 - Writing Fiction (3)
ENGL 5204 - Expository Writing (3)
ENGL 5205 - Advanced Expository Writing (3)
ENGL 5206 - Writing Creative Nonfiction (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5208 - Poetry Writing Workshop (3)
ENGL 5209 - Fiction Writing Workshop (3)
ENGL 5235 - History of the Book (3)
ENGL 5264 - Literacy in Family and Community (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5277 - Digital Literacies (3)
ENGL 5280 - Writing About Place (3)
ENGL 5290 - Advanced Creative Project (3)
ENGL 5400 - Research, Theory, and Practice of Tutoring Writing (3)
ENGL 6008 - Topics in Advanced Technical Communication (3)
ENGL 6062 - Topics in Rhetoric (3)
ENGL 6070 - Topics in English (3) *(Writing topic)*
ENGL 6073 - Topics in Creative Writing (3)
ENGL 6116 - Technical/Professional Writing (3)
ENGL 6166 - Rhetorical Theory (3)
ENGL 6181 - Composition Theory and Pedagogy (3)
ENGL 6182 - Research Theory and Method in Rhetoric and Composition (3)
ENGL 6183 - Critical Pedagogy and the Teaching of Writing (3)
ENGL 6195 - Teaching College English (3)

Comprehensive Examination
All students in the literature concentration must satisfactorily complete a written examination based on a reading list proposed by the student and approved by the Graduate Committee. Information about this list is available in the department office. The written examination may not be attempted sooner than the last semester of coursework, exclusive of thesis credits.

Master's Thesis (0-6 credit hours)
The thesis is optional for the Literature concentration. It may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (3-9 credit hours)
Students who elect the Thesis option above are required to take one additional elective course. Students who do not elect the Thesis option are required to take three additional elective courses. Elective courses require approval of the English Graduate Program Director.

Technical/Professional Writing Concentration

This concentration includes courses that: 1) provide students with an understanding of the theoretical and rhetorical foundation of the field, 2) introduce students to the methods and results of research in the field, 3) offer students an opportunity to practice theory and research through project work for clients, 4) address technology and science as socially constructed disciplines, and 5) help students build skills in written and oral communication, project management, and teamwork.

Core Courses (6 credit hours)
ENGL 6101 - Introduction to English Studies (3)
ENGL 6160 - Introduction to the English Language (3)

Required Courses (9 credit hours)
ENGL 5181 - Writing and Designing User Documents (3)
ENGL 6116 - Technical/Professional Writing (3) *(this course should be taken in the first year)*
ENGL 6166 - Rhetorical Theory (3)

Elective Technical Communication Courses (9 credit hours)
Select three of the following:
ENGL 5008 - Topics in Advanced Technical Communication (3) *(may be repeated for credit)*
ENGL 5180 - Theories of Technical Communication (3)
ENGL 5182 - Information Design and Digital Publishing (3)
ENGL 5183 - Editing with Digital Technologies (3)
ENGL 5235 - History of the Book (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5280 - Writing About Place (3)
ENGL 5410 - Professional Internship (3 or 6)
ENGL 6008 - Topics in Advanced Technical Communication (3) *(may be repeated for credit)*

Project/Thesis (3-6 credit hours)
All students in the Technical/Professional Writing concentration must submit either a project or a thesis to satisfy requirements for the degree.

Project
Students electing to submit a project to satisfy this requirement enroll in a course leading to the production of a project. Students consult with the English Graduate Program Director for details on the requirements for this project.

ENGL 6895 - Project (3)

Master's Thesis
The thesis may be either scholarly or creative. Students consult with the English Graduate Program Director, who will appoint a thesis committee comprising a director and two faculty readers.

ENGL 6996 - Thesis (6)

Unrestricted Elective Courses (6-9 credit hours)
Students who elect the Project option above select three additional elective courses. Students who elect the Thesis option above select two additional elective courses. Elective courses require approval of the English Graduate Program Director.

Degree Total = 36 Credit Hours

Grade Requirements
All courses counted toward the degree must be taken with grades of A or B received. A course in which a graduate student receives a grade of C is not allowable as part of the 36 required credit hours.

Advising
The English Graduate Program Director and other graduate faculty members acting as their designated assistants advise graduate students.

Assistantships
A number of graduate assistantships are available each year. Applications must be submitted by March 1 for assistantships beginning the following academic year. Further information is available in the Department of English.

Internships
The Department of English offers a number of internships for graduate students (limited to 3 hours of credit), which provide program-related experience in local television and radio stations, nonprofit and government agencies, and local businesses and corporations. Further information is available in the department.

ENGL 5410 - Professional Internship (3 or 6)

Licensure
For information on licensure in English, please see the requirements of the English Education concentration.

M.A. in English/M.F.A. in Creative Writing

The Department of English, in partnership with Kingston University London (KUL), offers a dual degree program in which a student may earn an M.A. in English with a Concentration in Creative Writing from UNC Charlotte and an M.F.A. in Creative Writing from KUL. The program aims to enable students to develop as creative writers through practice in more than one genre and through the creatively engaged study of literature, as well as to prepare students for professional advancement in fields such as writing, editing, publishing, or teaching on the secondary or college levels.

Admission Requirements
Students must have a B.A. in English or substantial coursework in English courses; some creative writing courses are desirable but not required.

Applications must be submitted online through the Graduate School at gradadmissions.charlotte.edu/apply by February 1. Materials to include:

- Application and fee
- Transcripts from all postsecondary institutions attended

- Three academic letters of recommendation (preferably from instructors who can address the student's writing achievements and potential)
- Statement of purpose (750 words maximum) tailored to the dual degree program, addressing whether the student is applying in poetry or fiction, their interests in writing and ambitions, their background and reasons for applying for this program, and how they are suited to handle an intensive program with an accelerated pace
- Creative writing sample (in PDF format) demonstrating highest quality recent work (for details, see the Department of English website at english.charlotte.edu/graduate-program-information/mamfa-dual-degree-program)

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Please note that students admitted to the UNC Charlotte M.A. program are conditionally admitted to the KU M.F.A. provided the student meets all UNC Charlotte requirements during the first year. They must perform satisfactorily, and complete all 24 credit hours, at UNC Charlotte before continuing on to KU to complete the M.F.A. requirements. This is a full-time residency program; part-time status or online courses are not options. Fall admission only.

Degree Requirements

This is a 36 credit hour program in which students earn 24 credit hours at UNC Charlotte in their first year, and spend one year at Kingston University London (KUL) to earn the additional 12 credit hours required for the M.A. Students take additional modules at KUL to meet the requirements for the M.F.A. This program requires a thesis to be written while at KUL that also satisfies the research portion of the UNC Charlotte degree.

UNC Charlotte Courses (24 credit hours)

Students spend their first academic year at UNC Charlotte and take the following:

Core Course (3 credit hours)
ENGL 6101 - Introduction to English Studies (3)

Elective Fiction Writing Course (3 credit hours)
Select one of the following:
ENGL 5203 - Writing Fiction (3)
ENGL 5206 - Writing Creative Nonfiction (3)
ENGL 5207 - Writing Young Adult Fiction (3)
ENGL 5208 - Poetry Writing Workshop (3)
ENGL 5209 - Fiction Writing Workshop (3)
ENGL 5280 - Writing About Place (3)

Elective Poetry Writing Course (3 credit hours)
Select one of the following:
ENGL 5202 - Writing Poetry (3)
ENGL 5208 - Poetry Writing Workshop (3)

Elective Creative Writing Courses (6 credit hours)
ENGL 6073 - Topics in Creative Writing (3)
ENGL 6073 - Topics in Creative Writing (3)

Elective Literature Courses (6 credit hours)
Select two of the following, one of which must be in modern and/or contemporary literature:
ENGL 5002 - Women and Literature (3)
ENGL 5072 - Topics in Literature and Film (3)
ENGL 5074 - Topics in Children's Literature, Media, and Culture (3)
ENGL 5090 - Major Authors (3)
ENGL 5102 - British Children's Literature (3)
ENGL 5103 - American Children's Literature (3)
ENGL 5104 - Multiculturalism and Children's Literature (3)
ENGL 5114 - Milton (3)
ENGL 5116 - Shakespeare's Early Plays (3)
ENGL 5117 - Shakespeare's Late Plays (3)
ENGL 5121 - The 18th-Century British Novel (3)
ENGL 5122 - The Victorian Novel (3)
ENGL 5123 - The Modern British Novel (3)
ENGL 5124 - Modern Irish Literature (3)
ENGL 5131 - British Drama to 1600, Excluding Shakespeare (3)
ENGL 5132 - British Drama from 1600-1642, Excluding Shakespeare (3)
ENGL 5133 - British Drama of Wit and Intrigue, 1660-1780 (3)
ENGL 5143 - The American Novel of the 19th Century (3)
ENGL 5144 - The American Novel of the 20th Century (3)
ENGL 5145 - Literature of the American South (3)
ENGL 5146 - Contemporary Jewish-American Literature (3)
ENGL 5147 - Early Black American Literature (3)
ENGL 5148 - 20th Century Black American Literature: Prose (3)
ENGL 5150 - Contemporary Poetry (3)
ENGL 5151 - Modern Drama (3)
ENGL 5152 - Modern European Literature (3)
ENGL 5153 - Contemporary Fiction (3)
ENGL 5155 - Pan-African Literature (3)
ENGL 5156 - Gender and African American Literature (3)
ENGL 5157 - African American Poetry (3)
ENGL 5158 - African American Literary Theory and Criticism (3)
ENGL 5210 - Greek and Roman Drama in Translation (3)
ENGL 5211 - Chaucer (3)
ENGL 5325 - Trauma and Memory in Contemporary American Literature (3)
ENGL 6072 - Topics in Literature and Film (3)
ENGL 6103 - Introduction to Children's Literature and Culture (3)

ENGL 6104 - Major Figures and Themes in Children's Literature (3)
ENGL 6111 - Shakespeare's Comedies and Histories (3)
ENGL 6112 - Shakespeare's Tragedies (3)
ENGL 6113 - Milton (3)
ENGL 6123 - The Augustan Age, 1660-1785 (3)
ENGL 6125 - The Romantic Era, 1785-1832 (3)
ENGL 6126 - The Victorian Era, 1832-1900 (3)
ENGL 6141 - American Romanticism (3)
ENGL 6142 - American Realism and Naturalism (3)
ENGL 6143 - American Modernism (3)
ENGL 6147 - Perspectives in African American Literature (3)
ENGL 6680 - Seminar in British Literature (3)
ENGL 6685 - Seminar in American Literature (3)
ENGL 6687 - Seminar in Global Literature (3)

Unrestricted Elective Course (3 credit hours)
Select any graduate ENGL course:
ENGL 5XXX - English Elective Course (3)
ENGL 6XXX - English Elective Course (3)

KUL Courses (12 credit hours)
In the second year of the program at KUL, students take the following modules:

- Advanced writers workshop
- Teaching creative writing
- Reading for writers
- Visiting speakers
- Research presentations
- Advanced dissertation project

12 credit hours of thesis taken at KUL is applied to the UNC Charlotte M.A. in English as M.A. project hours (ENGL 6895). In both semesters of the second year, students also register for the following UNC Charlotte placeholder course (no credit hours, no fees):

ENGL 6777 - UNCC-ENGLMFA (0)

Students in good standing who are unable to proceed to KUL in their second year may opt to continue in the M.A. in English at UNC Charlotte.

Dual Degree Total = 36 Credit Hours

Grade Requirements
All courses counted toward the degree must be taken with grades of A or B received. A course in which a graduate student receives a grade of C is not allowable as part of the 36 required credit hours. Students earning C grades in their first year will be ineligible for the KUL M.F.A. but may opt to continue in the M.A. in English at UNC Charlotte.

Graduate Certificate in Applied Linguistics

The Graduate Certificate in Applied Linguistics enables professionals to focus and solidify or update their work with language teaching, with applications in the language industry, or with research. The coursework leading to this certificate grounds the participants in theory and practice, providing linguistic expertise to anyone with related degrees and professional aspirations, and helping to prepare students for work in diverse professions, including:

- Intelligence gathering
- Human-machine interfaces (improving text-to-speech, speech recognition, and integrating language processing and real-world knowledge)
- Profiling
- Data mining
- Therapy
- Standardization of industrial terminology
- Localization of international products for a specific market or culture
- Forensics
- Translation/interpreting

Even in jobs that are not primarily language-oriented, this certificate can help students develop important market skills:

- Increased pragmatic awareness – the skill of recognizing how language works in social contexts, including how different cultures handle verbal behaviors such as requests, negotiations, conventions of politeness, and persuasion.
- Application – the ability to make the connection between theoretical knowledge and putting it to effective use, such as understanding how social power imposes specific constraints on grammar, word choice, and pronunciation.
- Clarity – the mastery of tailoring a message e towards a specific audience with maximum impact, including subliminal techniques (e.g. in advertising).
- Pattern extraction – the knowledge of how to identify and find specific patterns in very large bodies of data.
- Explication – understanding the difference between inductive modeling and deductive hypothesis forming, and the interplay between them.

This certificate is good for students interested in how people are swayed by framing a narrative one way or another, how to prepare materials for adult learners of language, how speech is produced, or how it is learned. It is also a good complement to several master's degree programs at UNC Charlotte such as psychology, computer

science, or anthropology.

Admission Requirements

- Statement of purpose
- Three letters of recommendation (preferably from professors)
- Writing sample
- GPA 2.75 or higher

Transfer credits are not accepted in this certificate program.

Certificate Requirements

The Graduate Certificate in Linguistics requires 15 credit hours in approved courses, including a minimum of 6 credit hours at the 6000-level. All coursework must be completed within five years from the time of first enrollment in a certificate course.

Students can orient their program towards either applied linguistics or the study of second-language research. Appropriate substitutions from other graduate programs on campus (i.e., not transfer credits) can be authorized by the Graduate Program Director of Applied Linguistics in the Department of English (if different) and by the director of the M.A. emphasis in Applied Linguistics. They will also act as advisors to those enrolled in this certificate program.

Students seeking licensure for the teaching of English at levels K-12 should consult the College of Education.

Required Courses (15 credit hours)

Select five of the following; 6 credit hours must be at the 6000 level.

ENGL 5161 - Modern English Grammar (3)
ENGL 5165 - Multiculturalism and Language (3)
ENGL 5166 - Comparative Language Studies for Teachers (3)
ENGL 5167 - The Mind and Language (3)
ENGL 5260 - History of the English Language (3)
ENGL 5262 - Language and Diversity (3)
ENGL 5263 - Linguistics and Language Learning (3)
or ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)
ENGL 5272 - Studies in the Politics of Language and Writing (3)
ENGL 6070 - Topics in English (3) *(if subject is linguistics)*
ENGL 6127 - Seminar in Language, Culture, and Society (3)
ENGL 6161 - Introduction to Linguistics (3)
ENGL 6162 - History of the English Language (3)
ENGL 6164 - Comparative Language Analysis for Teachers (3)
ENGL 6165 - Introduction to English for Specific Purposes (3)
ENGL 6167 - Research Methods in Applied Linguistics (3)
ENGL 6168 - Practicum in English for Specific Purposes (3)
ENGL 6195 - Teaching College English (3)

Certificate Total = 15 Credit Hours

Grade Requirements

Students must earn a B or above in all courses presented to the certificate.

Graduate Certificate in Technical/Professional Writing

The Graduate Certificate in Technical/Professional prepares students for careers that combine strong communication skills with technical expertise. Students explore the relationships among language, writing, and computing technologies. This program is specifically designed to prepare students for the challenges encountered in today's rapidly changing, technologically global society.

With a Technical/Professional Writing background students find careers in:

- computing-related industries, software and hardware
- engineering communication
- environmental communication
- government
- medicine
- other scientific or technical fields

As a technical writer, students are called upon to research, write, test, design or edit technical information for a variety of audiences, including:

- software and hardware documentation
- grants and proposals
- electronic multi-media presentations
- websites
- training materials

In addition to strong communication skills, technical writers must know a variety of computer applications, including word processing, web design software, page layout applications, online help authoring software, and hypertext mark-up language (HTML).

Admission Requirements

Students must apply for admission to the Graduate School and must have a minimum undergraduate GPA of 2.75. Applicants will be required to submit: 1) a current GRE score; 2) a current MAT score; or 3) a portfolio of professional-level documents. Only graduate courses taken at UNC Charlotte will count towards this Graduate Certificate.

Certificate Requirements

The Graduate Certificate in Technical/Professional Writing is designed for post-baccalaureate, graduate, and post-graduate students. Students can complete the required 15 graduate credit hours in approximately 1-2 years.

Required Core Courses (9 credit hours)

ENGL 5181 - Writing and Designing User Documents (3)
ENGL 6116 - Technical/Professional Writing (3)
ENGL 5410 - Professional Internship (3)
or ENGL 6895 - Project (3)

Elective Courses (6 credit hours)

Select two of the following:
ENGL 5008 - Topics in Advanced Technical Communication (3)
ENGL 5180 - Theories of Technical Communication (3)
ENGL 5182 - Information Design and Digital Publishing (3)
ENGL 5183 - Editing with Digital Technologies (3)
ENGL 5235 - History of the Book (3)
ENGL 5271 - Studies in Writing, Rhetoric, and New Media (3)
ENGL 5274 - Visual Rhetoric (3)
ENGL 5275 - Rhetoric and Technology (3)
ENGL 5280 - Writing About Place (3)
ENGL 6008 - Topics in Advanced Technical Communication (3)
Other Courses *(as appropriate and approved by the Department of English)*

Certificate Total = 15 Credit Hours

ETHICS AND APPLIED PHILOSOPHY

- M.A. in Ethics and Applied Philosophy
- Graduate Certificate in Applied Ethics

Department of Philosophy

philosophy.charlotte.edu

M.A. in Ethics and Applied Philosophy

The M.A. in Ethics and Applied Philosophy degree program is designed to foster the application of ethical and philosophical knowledge to currently pressing concerns in social, economic, medical, legal, commercial, cultural, and political contexts and associations. The department offers both theoretical and applied courses. These courses provide students with a comprehensive, normative, politically-informed and logically consistent training relevant to current challenges encountered in business, medical associations, national and international political contexts, as well as public education.

Admission Requirements

In addition to meeting the University's graduate admission requirements, all prospective students must submit:

- A personal statement outlining why the applicant seeks admission to the program
- A philosophical writing sample, preferably addressing an ethical or other philosophical issue, uploaded within the online application system
- Three academic letters of recommendation (to be uploaded by the Recommenders), attached to the recommendation forms required by the Graduate School, which address the student's philosophical skills and/or ethical reasoning ability

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Master of Arts in Ethics and Applied Philosophy requires the completion of a minimum of 30 credit hours of approved graduate coursework. The successful completion of the Master's Research Paper course is also required for the Master of Arts. Prior to starting a Master's Research Paper course, students in the M.A. program must apply for readmission if they have not taken any courses for two years. All degree requirements must be completed within seven calendar years of first enrollment in the program.

Up to 6 credit hours earned from a college or university accredited by an accepted accrediting body may be eligible for transfer credit. Formal approval must be obtained from the Graduate Program Director and the Dean of the Graduate School.

Most elective courses are Topics courses. Visit philosophy.charlotte.edu/graduate/courses/recent-offerings for details about recent offerings.

Required Courses (6 credit hours)

PHIL 6110 - Ethical Theory (3)
PHIL 6120 - Philosophical Methods and Analysis (3)

Elective Courses (21 credit hours)

Select from the following:
PHIL 5050 - Topics in Philosophy (1 to 3)
PHIL 6050 - Topics in Philosophy (1 to 3)
PHIL 6220 - Health Law and Ethics (3)
PHIL 6240 - Research Ethics in the Biological and Behavioral Sciences (3)
PHIL 6250 - Ethics of Public Policy (3)
PHIL 6260 - Ethics and International Affairs (3)
PHIL 6320 - Feminist Theory and Its Applications (3)
PHIL 6330 - Race and Philosophy (3)
PHIL 6340 - Philosophy of Mind (3)
PHIL 6410 - Internship in Ethics and Applied Philosophy (3)
PHIL 6800 - Independent Study (1 to 3)

Capstone Course (3 credit hours)

This course is offered annually and may be repeated for credit with new material.

PHIL 6999 - Master's Research Paper (3)

Degree Total = 30 Credit Hours

Grade Requirements

All coursework must be completed with a GPA of 3.0 or above.

Advising

The Graduate Program Director serves as formal advisor to graduate students.

Language Requirement

Although students are not required to demonstrate proficiency in a foreign language as a formal requirement of the program, they are expected to acquire competency in and use whatever languages they need to pursue their research interests.

Application for Degree

Graduation information, including deadlines for candidacy and degree application, are available online from the Graduate School at graduateschool.charlotte.edu/current-students/graduation-clearance.

Graduate Certificate in Applied Ethics

The Graduate Certificate in Applied Ethics is of interest to three groups of students: (1) professionals working in areas of applied ethics; (2) students just beginning to explore graduate work in philosophy; and (3) students in other master's and doctoral programs, such as biology, health administration, and public policy, who expect their careers to include work in applied ethics.

Admission Requirements

In addition to meeting the University's graduate admission requirements, all prospective students must:

- Submit a personal statement outlining why the applicant seeks admission to the program
- Submit two academic letters of recommendation, in addition to the recommendation forms required by the graduate school, which address the student's philosophical skills and/or ethical reasoning
- Hold a bachelor's degree from a college or university accredited by an accepted accrediting body
- Have earned a minimum undergraduate GPA of 2.75

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Certificate Requirements

The Graduate Certificate in Applied Ethics requires the completion of 15 credit hours of graduate coursework in philosophy. Most elective courses are Topics courses. Visit philosophy.charlotte.edu/graduate/courses/recent-offerings for details about recent offerings.

Required Course (3 credit hours)

PHIL 6110 - Ethical Theory (3)

Elective Courses (12 credit hours)
Select from:
PHIL 5050 - Topics in Philosophy (1 to 3)
PHIL 6050 - Topics in Philosophy (1 to 3)
PHIL 6120 - Philosophical Methods and Analysis (3)
PHIL 6220 - Health Law and Ethics (3)
PHIL 6240 - Research Ethics in the Biological and Behavioral Sciences (3)
PHIL 6250 - Ethics of Public Policy (3)
PHIL 6260 - Ethics and International Affairs (3)
PHIL 6320 - Feminist Theory and Its Applications (3)
PHIL 6330 - Race and Philosophy (3)
PHIL 6340 - Philosophy of Mind (3)

Approval of the Department of Philosophy Graduate Program Director is required in order to substitute related courses offered by other departments and programs.

Certificate Total = 15 Credit Hours

Advising
The Graduate Program Director serves as formal advisor to graduate students.

Transfer Credit
Transfer credit is not accepted in the certificate program.

GENDER, SEXUALITY, AND WOMEN'S STUDIES

- Graduate Certificate in Gender, Sexuality, and Women's Studies

Graduate Program
womensandgenderstudies.charlotte.edu

Graduate Certificate in Gender, Sexuality, and Women's Studies

The Graduate Certificate in Gender, Sexuality and Women's Studies can be earned in conjunction with master's or doctoral work in a wide variety of subjects. The certificate can also be earned through a freestanding course of study not linked to a graduate degree. The Graduate Certificate in Gender, Sexuality and Women's Studies exposes students from a variety of disciplines to the core theories and approaches used in studies of women, gender (which includes masculinity), feminism, and sexuality.

Admission Requirements
The certificate program is open to all students who hold a bachelor's degree from a college or university accredited by an accepted accrediting body and either:

1.) are enrolled and in good standing in a graduate degree program at UNC Charlotte, or
2.) have a minimum undergraduate GPA of 3.0

All students are admitted to the Graduate School in a special category for certificate programs. In addition to the general requirements for graduate certificate programs explained under the "Degree Requirements and Academic Policies" section of the *Catalog*, students should submit a letter explaining the applicant's educational and work background, interests, and plans, with an emphasis on how this certificate will enhance, complement, or advance the applicant's work and/or education. Letters of recommendation are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the

Graduate Catalog for more information about Early Entry Programs.

Certificate Requirements

The Graduate Certificate in Gender, Sexuality and Women's Studies requires the completion of a minimum of 12 credit hours of graduate coursework. This includes 2 core courses and 2 elective courses. Transfer credit is not accepted in the certificate program.

Core Courses (6 credit hours)

Select two of the following that most closely reflect students' interests:

WGST 5160 - Race, Sexuality, and the Body (3)
WGST 5170 - Queer Theory (3)
WGST 5180 - Introduction to Gender, Sexuality, and Women's Studies (3)
WGST 6601 - Theoretical Approaches to Sexuality (3)
WGST 6602 - Theoretical Approaches to Gender (3)
WGST 6603 - Language, Gender and Power (3)
WGST 6627 - Feminist Theory and its Applications (3)

Elective Courses (6 credit hours)

Select two from the following:

WGST 5xxx - Women's and Gender Studies Elective (3)
WGST 6xxx - Women's and Gender Studies Elective (3)

For elective courses from other departments and programs to count as an elective, students must submit a course description and/or syllabus and receive written approval from the Graduate Program Director prior to registration.

Certificate Total = 12 Credit Hours

GEOGRAPHY AND EARTH SCIENCES

- Ph.D. in Geography
  - Earth and Environmental Systems
  - Geographic Information Science
  - Urban and Regional Analysis
- Ph.D. in Infrastructure and Environmental Systems *(see The William States Lee College of Engineering section)*
- M.A. in Geography
  - Business Location and Transportation Analytics
  - Geographic Information Science and Technology (GIS&T)
  - Human and Environmental Systems
  - Urban and Regional Analysis
  - Urban Planning
- M.S. in Earth Sciences
- Graduate Certificate in Geographic Information Science and Technology

Department of Geography and Earth Sciences

geoearth.charlotte.edu

Ph.D. in Geography

Students in the Ph.D. in Geography program at UNC Charlotte graduate at the cutting edge of geographic knowledge, instruction, and practice, both within and beyond the academy. Building on the expertise and research strengths of the graduate faculty in Geography and Earth Sciences, there are three areas of focus within the doctoral Geography program.

1) Urban and Regional Analysis
2) Earth and Environmental Systems
3) Geographic Information Science

These concentrations serve as frameworks upon which to build a specialized degree but are complementary and can be integrated to suit individual student interests and supervising faculty expertise. All three concentrations share a common set of required courses, offering students core training in the theoretical and methodological foundations of the discipline of Geography. A strength of the program is its dual emphasis on academic and professional development. Students contribute to faculty led research and outreach teams; cultivate relationships with partners in other disciplines and institutions; attend and present research at national and international

conferences; and prepare to serve as instructors of their own courses prior to graduation. Doctoral students in the program have established a tradition of professional engagement and leadership in the department, across campus, and within associations such as the American Association of Geographers, and its many specialty groups.

Concentrations

Urban and Regional Analysis

Cities and the regions in which they are embedded are complex, multi-scalar systems. They consist of economic, social, cultural, political, and environmental sub-systems. The Concentration in Urban and Regional Analysis emphasizes the theoretical and empirical analysis of cities and their broader regional, national and global linkages. Students engage in coursework and research that lead to expertise in areas such as economic restructuring; urban planning and policy; quality of life; community health; smart community initiatives; geographies of consumption; central city revitalization; suburban, ex-urban and urban periphery development and change; immigrant settlement and economy; global and globalizing cities and systems; regional and global logistics systems; mobility and transportation; urban ecology; sustainability and environmental justice. The city of Charlotte and its relationship with local, regional, and global urban systems is a common area of focus for graduate students. As one of the most dynamic urban areas in the country, Charlotte offers an ideal context for examining urban complexity at both internal and external scales. Scholarship in national and international comparative studies of urban regional systems is also fostered in this concentration. Students concentrating in Urban and Regional Analysis receive rigorous training in the research approaches, mixed methods, and theoretical constructs necessary to shape urban dynamics through careers in public, private, and nonprofit sector leadership, as well as higher education.

Earth and Environmental Systems

Earth and Environmental Systems is a multidisciplinary concentration in physical geography dedicated to understanding the natural features and phenomena occurring at and near the Earth's surface, as well as the human interactions with these connected systems. Doctoral students have the opportunity to work with faculty on innovative research questions related to lithosphere, atmosphere, biosphere, and hydrosphere systems at a variety of spatial and temporal scales. Students develop an understanding of the Earth's past, present, and future natural systems, their spatial distributions, and how human societies interact with and influence them. This understanding may ultimately lead to the development of sustainable solutions that could address current or emerging issues of environmental concern. The Department of Geography and Earth Sciences houses facilities and resources that enable students to pursue cutting-edge, impactful research questions using the latest field, laboratory, and computational methods, as well as Geographical Information Science (GIScience) and remote sensing technologies.

Geographic Information Science

Geospatial data used in research, public affairs, and private business is increasingly pervasive and traceable to geographic positions. The Concentration in Geographic Information Science (GIS) examines the nature of geographic data and information, and methods of capture, measurement, analysis, and modeling of this information to advance our understanding of complex geographic phenomena. Research is articulated around the representation, numerical modeling and dissemination of spatially explicit information with state-of-the-art computational analytics. Ph.D. students in this rapidly evolving field at the interface of data, social, and natural sciences develop proficiency in state-of-the-art geospatial data analytics for an understanding of social and environmental processes of geographic systems across multiple spatial and temporal scales. In conjunction with a critical awareness of the content of geospatial information, students can build expertise in several sub-areas spanning from geocomputational modeling and simulation, cyberGIS, big spatial data analytics, social network analysis, satellite/airborne remote sensing, spatial data mining and machine learning, spatial statistics and geovisual analytics. The internationally respected GIS faculty are well engaged in research on urban and regional socio-economic systems processes, transportation analytics, landscape and environmental systems, public health, energy, land change, sustainability, and resilience.

Admission Requirements

In addition to the general requirements for admission to the UNC Charlotte Graduate School, the following are required for study to the Ph.D. in Geography. Under most circumstances, students admitted to the program will have:

1) Master's degree in Geography or field related to the primary emphases of the program. While students may initially be enrolled in the program while finishing their master's degree, documentation of master's degree conferral from issuing university is required for continuation of Ph.D. in Geography enrollment beyond the first semester.
2) A master's level GPA of at least 3.5 out of 4.0.
3) In exceptional cases, students with only a completed baccalaureate degree may be admitted. However, this is rare and requires approval from the program Graduate Advisory Committee and the Graduate Program Director following written recommendation from faculty member who agrees to serve as the prospective student's primary doctoral advisor, and who outlines why waiving the master's degree

requirement is justified. To be considered for admission with only a completed baccalaureate degree, a student must have an overall undergraduate GPA of at least 3.6, demonstrated research competency, and meet or exceed all other admission requirements. Students without a master's degree or prior master's level coursework should be prepared to complete additional coursework to ensure they have met prerequisites and are ready to engage in Ph.D. level study.

4) Transcripts of all previous college coursework. Transcripts are evaluated on the basis the type and range of geographical, spatial, statistical, and technical courses attempted as well as the strength of performance in these areas, and on the depth and suitability of the applicant's preparation for doctoral level coursework and research in the field of geography.
5) Graduate Record Examination (GRE) with minimum scores of 150 on both the verbal and quantitative sections and a 3.5 or above on the analytical portions. Applicants must have taken the GRE; no other test is accepted in its place.
6) For applicants whose native language is not English, an IELTS overall score of at least 6.5 or a TOEFL exam score of at least 84 on the Internet-based test. The program expects a minimum score in the low to mid 20s on each of the components of the TOEFL. In addition, international students who are supported through a teaching assistantship (TA) will be required to undergo evaluation by the English Language Training Institute (ELTI) at UNC Charlotte prior to beginning their assistantship.
7) Proficiency in quantitative methods at a minimum of the linear regression level is expected. If absent, other coursework, as determined by the program's Graduate Advisory Committee, may be required depending on the background of the student.
8) GIS proficiency at a minimum of the applications level is expected. If absent, other coursework, as determined by the program's Graduate Advisory Committee, may be required depending on the background of the student.
9) Three letters of recommendation, at least two of which must come from faculty in the student's previous academic programs.
10) A personal statement which directly addresses why the student wishes to do graduate work in Geography and why they wish to participate in the Ph.D. in Geography program at UNC Charlotte. The statement should address how the program at UNC Charlotte fits career and/or professional goals and how the applicant would benefit from and contribute to the Ph.D. in Geography at UNC Charlotte. This statement is very important in determining the applicant's commitment to graduate education and to a professional career in geography or a related field.

Degree Requirements

51 credit hours of approved coursework is required, encompassing 15 credit hours of required courses, 18 credit hours of elective courses and 18 dissertation credit hours. Students are also required to pass a three-part qualifying examination, as well as an oral defense of both the dissertation proposal and the final dissertation. In addition to program requirements, all doctoral students are required to successfully complete a non-credit bearing course for academic integrity.

Academic Integrity Course

GRAD 8990 - Academic Integrity (0)

Required Courses (15 credit hours)

All core courses must be taken in residence at UNC Charlotte.

GEOG 8124 - Seminar in Geographic Theory and Practice (3)
GEOG 8125 - Geographic Information Science and Technology (4)
GEOG 8131 - Research Design Fundamentals (3)
GEOG 8632 - Ph.D. Professional Development Seminar (1)
(taken twice for a total of 2 credit hours; once in the first year during the Fall semester and once in the third year during the Fall semester)
GRAD 8104 - Spatial Statistics (3)
or GEOG 8115 - Qualitative Methods in Geography (3)

Elective Courses (18 credit hours)

In consultation with their Faculty Advisor, students select and successfully complete a minimum of 18 credit hours of elective courses that build towards measureable expertise in the discipline, the student's chosen concentration and the methods and approaches central to the conducting of rigorous geographic research. Of the 18 credit hours of elective courses, no more than 9 credit hours can come from outside the department (GEOG or ESCI).

Dissertation Research (18 credit hours)

GEOG 8901 - Dissertation (1 to 9)

Degree Total = 51 Credit Hours

Grade Requirements

All graduate students are subject to academic suspension and/or termination. Department academic standards deviate slightly from University policies stated in appropriate catalogs. A student must maintain a cumulative average of 3.0 in all coursework taken in the program. An accumulation of one (1) marginal (C) grade results in the student being placed on probationary status within the program and could lead to the student being required to re-take the course, and a potential loss of

funding if the student is receiving University-sourced funding. An accumulation of two (2) marginal (C) grades results in suspension of the student's enrollment in the graduate program. A graduate student whose enrollment has been suspended because of grades is ineligible to register in any semester or summer session unless properly reinstated through the suspension appeal process. A maximum of one (1) C grade can be applied towards the PhD. As such, if a student is reinstated following a grade related suspension, they must retake at least one of the courses for which the C grade was initially issued and achieve a grade of B or above. An accumulation of three (3) marginal (C) grades or one (1) unsatisfactory (U) or one (1) NC grade results in termination of the student's enrollment in the graduate program. Furthermore, a second failure in the qualifying examinations; the dissertation proposal defense; or final dissertation defense also results in dismissal from the program. In order to continue a program of study, the student must pursue reinstatement through the termination appeal process or wait a period of two years before applying for readmission to the program.

Transfer Credit

A maximum of 9 credit hours or three courses of Ph.D.-level elective coursework can be transferred from a graduate program from a college or university accredited by an accepted accrediting body as part of the 51-credit hour requirement. This includes credit hours earned in a master's program at UNC Charlotte. All transfer credit requires Advisor recommendation and Program Director approval, and must be in compliance with program and Graduate School policy. Internship, dissertation, thesis, or capstone research hours are not eligible for transfer.

Qualifying Examination

Following successful completion of all required core courses (with the exception of a student's 2nd enrollment in GEOG 8632) and at least 15 credit hours of elective coursework, and upon the recommendation of the Faculty Advisor, students sit for a three-part, written, qualifying examination. For full-time students, this generally occurs no later than the end of the 4th semester or early in the 5th semester of enrollment in the program. Part I of the qualifying examination addresses the theoretic and contemporary literature of geography generally covered in the required coursework. Part II assesses student competency in research methods and techniques. Part III evaluates student competence in their sub-field of research specialization.

The qualifying examination is set and graded by an Examination Committee composed of faculty who teach in the doctoral program and from whom the student has taken coursework relevant to the exam. More specifically, Part I is set and graded by the instructor of GEOG 8124; Part II is set and graded by the instructor(s) who taught the student one or more of their core methods or techniques courses; and Part III is most commonly set by the student's primary advisor with whom the student has most closely worked to develop her or his primary area of sub-disciplinary expertise. The Examination Committee is appointed by the Geography Doctoral Program Director in consultation with the student's Faculty Advisor. All three components of the examination must be completed within a one month timeframe.

If a student fails the qualifying examination or any portion of the exam, they must wait until the next semester to retake the failed part or parts of the examination. During the interim period, the student may be required to retake courses in which the Examination Committee determines there is a deficiency. If a student fails the qualifying examination or any portion of the exam a second time, the program will request termination of the student's enrollment for a lack of satisfactory academic progress.

Faculty Advisor and Dissertation Committee

All students in the program have both a Faculty Advisor and Dissertation Committee. The Faculty Academic Advisor is assigned upon admission to the program and assists the student in formulating a Program of Study, including a potential dissertation topic. The Faculty Academic Advisor often continues to serve as Chair of the Dissertation Committee who must be a member of the Department of Geography and Earth Sciences. The Dissertation Committee should have at least three additional members, two of whom are chosen by the student and are usually members of the Department of Geography and Earth Sciences. The final member of the Dissertation Committee is a Graduate School representative appointed by the Dean of the Graduate School. All members of the Dissertation Committee must be members of the Graduate Faculty.

Dissertation Proposal and Advancement to Candidacy

Advancing to candidacy requires that the student pass the qualifying exam and write and successfully defend a dissertation proposal. The proposal must be submitted to the student's Advisory Committee for preliminary approval and then to the Program Coordinator and the Dean of the Graduate School. Successful defense of the dissertation proposal is followed by advancement to candidacy.

Dissertation

The culminating product of the program is the student's dissertation. Each dissertation is expected to be based on independent and original research which contributes to the body of knowledge in the discipline of Geography and to the student's sub-field of study. Dissertations are to be prepared and submitted in monograph format.

Candidates must supply a copy of their dissertation to their committee at least three weeks prior to the final defense. The document is evaluated through an oral defense with the student's dissertation committee and other graduate faculty as per Graduate School guidelines. Only after all recommended changes flowing from the oral defense are made and approved by the faculty advisor and dissertation committee may a student submit her/his final dissertation to the Graduate School. The final defense must be held on campus at UNC Charlotte. Candidates must publically announce the date and time for the final defense at least two weeks prior to the event.

If a student fails either the written or oral portion of the dissertation defense, they must wait until the next semester to redefend. During the interim period, the student works closely with her/his Advisor and Dissertation Committee to address areas where deficiencies were identified. If a student fails the dissertation defense a second time, the graduate program will request termination of the student's enrollment for a lack of satisfactory academic progress.

Time Limits for Completion of the Degree

It is generally expected that full-time students complete coursework within a two-year timeframe and the dissertation completed one to two years later. Students must achieve admission to candidacy within six years after admission to the program. Regardless of whether a student has proceeded through the program full-time or part-time, all courses applied towards the doctoral degree must have been taken within nine years after first registration as a doctoral student (regardless of whether courses were taken at UNC Charlotte or another institution). Further, the oral examination in defense of the dissertation must be passed within five years after being advanced to candidacy.

Assistantships and Other Support

The Ph.D. in Geography program at UNC Charlotte endeavors to secure funding support for our most competitive students in one of three ways: 1) externally funded Research Assistantships (RAs) offered by faculty through their granting activity and research programs; 2) program or university funded Graduate Assistantships (GAs) that can be teaching focused; research focused; administration focused or a combination thereof; or 3) externally funded scholarships, fellowships, or internships.

Many of our doctoral program faculty have active and externally funded research programs that are core sources of funding support (and training) for doctoral students.

For students not supported through advisor-funded RAs, the program offers a number of competitive Graduate Assistantships (GAs) which are awarded for a single semester or for an entire academic year (2 semesters or 9 months). Program Assistantships are renewable (based on academic and assistantship performance; advisor recommendation and program director approval) but generally only up to the end of the 8th semester or 4th academic year dated from a student's initial semester of enrollment in the program. Such GAs are normally scheduled for 16 weeks per semester and require the student to work for 20 hours per week. Graduate Assistantship assignments range from support of departmental teaching in which as student serves as either a teaching assistantship to faculty or, for more advanced students, as instructor of record for their own course; to support of faculty led research projects, outreach endeavors or other professional activities; to administrative support of departmental or programmatic initiatives. University policy dictates that acceptance of a Graduate Assistantships prohibits students from working for more than 20 hours per week in any paid activity on or off campus.

Students funded through faculty-supported RAs or awarded one of our program's competitive GAs are nominated for UNC Charlotte's Graduate Assistant Support Plan (GASP). GASP is a competitive support package used to attract top doctoral students to UNC Charlotte. If successful in the competition, doctoral students supported on a GA (or other qualifying award) receive tuition and health insurance for the academic year (fall and spring semesters). GASP is renewable for a limited number of semesters as per Graduate School guidelines. In addition to GASP, the UNC Charlotte Graduate School administers a number of philanthropic fellowships and awards for which eligible students are encouraged to apply.

Our doctoral students have a strong record of success in fellowship and scholarship competitions at the national level. Working in partnership with their academic advisors, Geography doctoral students are strongly encouraged to apply for external support from agencies such as, but not limited to, National Science Foundation, National Institutes of Health, Society of Women Geographers, United States Environmental Protection Agency, National Oceanic and Atmospheric Administration, and Association of American Geographers. Professional development is an important cornerstone of the doctoral program. As such, Ph.D. in Geography students are encouraged to present their independent and assistantship research at regional, national, and international academic and professional conferences. Financial support for these presentations is often available from the program (subject to budget conditions). Additionally, many of our doctoral students are offered opportunities to work with faculty over the summer months as Graduate Assistants supporting research, teaching and/or outreach initiatives that are either funded through faculty grants or contracts or

through the awarding of a competitive summer GA offered through the Ph.D. in Geography program itself.

M.A. in Geography

The Master of Arts in Geography emphasizes the application of skills, methods, and theories to solve geographic problems in contemporary society. To this end, students gain a solid foundation in spatial, locational, and planning theory, research methods (quantitative and qualitative), and Geographic Information Science and Technology (GIS&T).

Building on the strengths and research interests of the graduate faculty in the Department of Geography and Earth Sciences and colleagues across campus, there are five areas of concentration within the geography program:

1) Business Location and Transportation Analytics
2) Geographic Information Science and Technology (GIS&T)
3) Human and Environmental Systems
4) Urban and Regional Analysis
5) Urban Planning

One of the program's greatest strengths is the collaborative relationship between students and faculty. Research partnerships and a strong sense of community among students themselves are considered essential components of the learning and teaching environment in the Department of Geography and Earth Sciences and at UNC Charlotte more generally. An additional strength is community engagement with local partners. Students engage in service- or problem-based learning, participatory research and outreach with neighborhoods, and/or internships with local businesses, non-profits, and public agencies. Students are actively involved in research, scholarship, and professional development that is rigorous and reflective of real-world needs in the Charlotte community and beyond.

The geography program at UNC Charlotte is recognized as one of the best applied programs in the country enrolling on a competitive basis more than 30 students each year. Graduates go directly into jobs as professional geographers, planners, research and/or marketing specialists, location analysts, GIS&T specialists, and consultants in the public, non-profit, and private sectors.

An increasing number of M.A. in Geography graduates have also chosen to study at the Ph.D. level both within the doctoral program at UNC Charlotte and others across the county. Recognizing the distinctive nature of these two paths, a cornerstone of the program is that students are given the option to complete their degrees with either an applied capstone project or a more traditional research thesis.

Admission Requirements

In addition to the general requirements for admission to the UNC Charlotte Graduate School, the following are required for study to the M.A. in Geography:

- Under most circumstances, students admitted to the program must have: a **B.A. or B.S. degree in Geography** or field related to the primary emphases of the program.
- **Grade Point Average (GPA)**: in general, the department would prefer an overall undergraduate GPA above 3.1 (or a 3.1 for the last 2 years) and a GPA of 3.2 in the major. However, averages less than these do not exclude applicants if the other elements of the application are strong.
- **Transcripts of College Coursework**: transcripts are evaluated on the basis of types of courses attempted, range of geography, statistical, and computer coursework attempted. Not only is the applicant evaluated on the strength of the performance in these areas, but also on the range, depth and suitability of the applicant's preparation for graduate level coursework.
- **Graduate Record Examination (GRE)** with minimum scores of 150 on both the verbal and quantitative sections and a 3.5 or above on the analytical portions. Applicants must have taken the GRE; no other test is accepted in its place. Scores less than these suggested minimums do not automatically exclude applicants if the remainder of the applicant's file is strong.
- **TOEFL exam scores** of at least 84 on the Internet-based test for applicants whose native language is not English. The program expects a minimum score in the low to mid 20s on each of the components of the TOEFL. In addition, international students who are supported through a teaching assistantship (TA) are required to undergo evaluation by the English Language Training Institute (ELTI) at UNC Charlotte prior to beginning their assistantship.
- **Letters of Recommendation:** Three letters of reference are required. Letters from college or university teachers who have worked with and/or taught applicants are preferred. These letters are evaluated on the basis of how well the applicant is suited in terms of intellect, motivation and temperament to do graduate coursework.
- **Personal Essay:** Applicants must write a personal essay which directly addresses why they wish to do graduate work in geography and why they wish to participate in the M.A. program at UNC Charlotte. They should address directly how the program at UNC Charlotte fits their career and/or professional goals and how they would benefit from and

contribute to the M.A. in Geography at UNC Charlotte. This essay is very important in determining the applicant's commitment to graduate education and to a professional career in geography or a related field. Careful consideration of what goes into this essay is time well spent.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Prerequisite Requirements

All prospective graduate students must demonstrate competence in the undergraduate subject matter in their area of study. While the Department does not require that applicants have a degree in Geography, prospective graduate students should provide evidence that they are prepared to immediately take full advantage of graduate level coursework in Geography.

Students applying to the program should, at a minimum, be familiar with the concepts and materials offered in courses such as basic Economic Geography, Introduction to Spatial Analysis, Location Theory, and Introduction to Research Methods or Statistics. Any student wishing to pursue additional training in Geographic Information Systems (GIS) should have basic cartography preparation and computer file management and database skills.

Assistantships

Graduate assistantships are awarded on a competitive basis and arranged for either one entire semester or for an entire academic year (2 semesters or 9 months). They are normally scheduled for 15 weeks per semester and the student works 20 hours per week.

Degree Requirements

The M.A. in Geography requires a minimum of 36 credit hours of graduate work. The composition of this coursework (required vs. elective) differs across concentrations as detailed below. All students must, as a part of their total 36 credit hours, complete a minimum of 6 credit hours of capstone credit. In addition, all students are required to pass an oral defense of both the proposal and the final version of their individual capstone project.

Up to 12 credit hours may be taken in related work, which includes all transfer credit, credit by exam, and coursework in other departments at or above the 5000 level. At the discretion of the department, transfer credit totaling up to 6 credit hours may be accepted from a college or university accredited by an accepted accrediting body. No student may take more than 6 credit hours in graduate level independent study (GEOG 6800).

Elective Courses:

- Other 5000- or 6000-level courses in Geography with a minimum of 12 credit hours
- Related work (outside the department) or transfer credits in courses numbered 5000 and above with a maximum of 12 credit hours

Required Courses for All Concentrations

GEOG 6124 - Seminar in Geographic Theory and Practice (3)
GEOG 6125 - Geographic Information Science and Technology (4)
GEOG 6131 - Research Design Fundamentals (3)
GEOG 7900 - Individual Research Project (1 to 6)
GRAD 6101 - Linear Regression (3)*

** Students have a choice, after discussing with their academic advisor, to substitute GRAD 6101 with another statistical course offered within or outside the Department of Geography and Earth Sciences to meet their research needs.*

Concentrations

Students may elect to study in one or a combination of the five concentrations.

Business Location and Transportation Analytics

The Business Location and Transportation Analytics concentration aims to enhance students' knowledge of theories, techniques, and models of business location analytics and transportation analytics used by practitioners in the public and private sectors of the economy. This concentration is focused on business location decisions and practices in urban, regional, and national contexts, including commercial and institutional site selection and evaluation, economic development, and the use of transportation and mobility systems in contemporary societies, including infrastructure development, socio-economic impacts, and the structuring effect of transportation systems on urban and regional geographies. The concentration offers coursework in retail and office location, real estate development, transportation, logistics, regional economic development, business intelligence and methods of geospatial, census, and network data analytics. This concentration prepares students for jobs in location research with retailer and service firms, real estate developers, consulting firms, jobs in transportation analysis with various groups of service providers (carriers, freight forwarders, logistics managers, transit agencies), jobs with economic development agencies, or for continued academic training in economic and transport geography.

GEOG 5108 - Sport, Place, and Development (3)
GEOG 5132 - Spatial Modeling for Social and Economical Applications (3)
GEOG 5155 - Retail Location (3)
GEOG 5160 - The Geography of Transportation Systems (3)
GEOG 5210 - Urban Planning Methods (3)
GEOG 5240 - Geography of Knowledge and Information (3)
GEOG 5255 - Applied Population Analysis (3)
GEOG 5260 - Transportation Policy Formulation (3)
GEOG 5265 - Transportation Analysis Methods (3)
GEOG 6000 - Topics in Urban and Regional Analysis (3)
GEOG 6015 - Topics in Regional Geography (3)
GEOG 6030 - Topics in Geographic Techniques (3)
GEOG 6103 - Real Estate Development (3)
GEOG 6105 - Applied Real Estate Development (3)
GEOG 6123 - The Urban Region (3)
GEOG 6205 - Geovisualization (3)
GEOG 6210 - The Restructuring City (3)
GEOG 6212 - Urban Labor Markets (3)
GEOG 6300 - Applied Regional Analysis (3)
GEOG 6301 - Industrial Location (3)
GEOG 6302 - Regional Economic Development (3)
GEOG 6305 - Site Feasibility Analysis (3)
GEOG 6306 - Store Location Research (3)
GEOG 6408 - Spatial Optimization (3)
GEOG 6500 - Urban Planning: Theory and Practice (3)
GEOG 6600 - Transportation Policy (3)
CEGR 5162 - Transportation Planning (3)
CEGR 5171 - Urban Public Transportation (3)
CEGR 6182 - Transportation Systems Analysis (3)
ECON 5160 - Economics of Transportation (3)
ECON 6238 - Real Estate and Urban Economics (3)
ECON 6250 - Advanced Urban and Regional Economics (3)
EMGT 6920 - Logistics Engineering and Management (3)
GRAD 6104 - Spatial Statistics (3)
MBAD 6208 - Supply Chain Management (3)

Geographic Information Science and Technologies (GIS&T)

Geospatial data used in research, public affairs, and private business is increasingly pervasive and traceable to geographic positions. The Geographic Information Science and Technology focus examines the nature of geographic data and information, and methods of capture, measurement, analysis, and modeling of this information to advance our understanding of complex geographic phenomena. Research is articulated around the representation, numerical modeling, and dissemination of spatially explicit information with state-of-the-art computational analytics. M.A. students in this rapidly evolving field at the interface of data, social, and natural sciences develop proficiency in state-of-the-art geospatial data analytics for an understanding of social and environmental processes of geographic systems across multiple spatial and temporal scales. In conjunction with a critical awareness of the content of geospatial information, students can build expertise in several sub-areas spanning from geocomputational modeling and simulation, cyberGIS, big spatial data analytics, social network analysis, satellite/airborne remote sensing, spatial data mining and machine learning, spatial statistics, and geovisual analytics. The internationally respected GIS&T faculty are well engaged in research on urban and regional socio-economic systems processes, transportation analytics, landscape and environmental systems, public health, energy, land change, sustainability, and resilience.

ESCI 5170 - Fundamentals of Remote Sensing (4)
ESCI 5180 - Digital Image Processing in Remote Sensing (4)
GEOG 5101 - Cartographic Techniques (3)
GEOG 5102 - Cartographic Design and Map Construction (3)
GEOG 5103 - Computer Programming for GIS Applications (3)
GEOG 5131 - Environmental Modeling with GIS (4)
GEOG 5132 - Spatial Modeling for Social and Economical Applications (3)
GEOG 5150 - Spatial Database Development with GPS and GIS (3)
GEOG 6205 - Geovisualization (3)
GEOG 6407 - Geocomputation (3)
GEOG 6408 - Spatial Optimization (3)
GRAD 6104 - Spatial Statistics (3)
ITCS 5121 - Information Visualization (3)
ITCS 5122 - Visual Analytics (3)
ITCS 5145 - Parallel Computing (3)
ITCS 6114 - Algorithms and Data Structures (3)
ITCS 6140 - Data Visualization (3)
ITCS 6162 - Knowledge Discovery in Databases (3)

Human and Environmental Systems

The Human and Environmental Systems concentration focuses on interactions between human social systems and their associated physical environment. Students integrate coursework and research in urban ecology, environmental justice and equity, environmental and social sustainability, planning, climate change, paleoecology, and earth sciences. Students should take a mix of courses that address knowledge and understanding of environmental systems, social systems, and social-ecological interactions. The Department of Geography and Earth Sciences houses facilities and resources that enable students to pursue cutting-edge, impactful research questions using the latest field, laboratory, and computational methods, as well as Geographic Information Science (GIScience) and remote-sensing technologies.

ESCI 5000 - Selected Topics in Earth Sciences (1 to 4)
ESCI 5170 - Fundamentals of Remote Sensing (4)
ESCI 5180 - Digital Image Processing in Remote Sensing (4)
ESCI 5222 - Watershed Science (3)
ESCI 5233 - Geoenvironmental Site Characterization (4)

ESCI 6000 - Selected Topics in Earth Sciences (1 to 4)
ESCI 6105 - Landscape Assessment (4)
ESCI 6201 - Earth Systems Analysis: Climate (3)
ESCI 6202 - Earth Systems Analysis: Biogeochemical Cycles (3)
ESCI 6250 - Urban Air Quality (3)
GEOG 5131 - Environmental Modeling with GIS (4)
GEOG 5150 - Spatial Database Development with GPS and GIS (3)
GEOG 6030 - Topics in Geographic Techniques (3)
GEOL 5140 - Coastal Geology (3)
GEOL 5185 - Mineralogy, Economics and the Environment (3)
GEOL 6102 - Earth Systems Analysis: Paleoenvironments (3)

Urban and Regional Analysis

The Urban and Regional Analysis concentration emphasizes place-based learning and research on pressing social, economic, political and cultural dynamics facing cities, and the urban systems to which they belong. The concentration trains students to apply traditional and innovative methods and theoretical perspectives on urban form, function, and interconnections at all geographic scales with a view to addressing contemporary challenges such as urban development, suburbanization, sustainability, mobility, migration and settlement, economic transition, technological development, infrastructure provision, and demographic and cultural change. Students concentrating in Urban and Regional Analysis receive rigorous applied instruction that leads to careers in the public, private, and nonprofit sectors, as well as continued academic training in urban, economic, transportation, social, and cultural geography.

GEOG 5108 - Sport, Place, and Development (3)
GEOG 5132 - Spatial Modeling for Social and Economical Applications (3)
GEOG 5160 - The Geography of Transportation Systems (3)
GEOG 5210 - Urban Planning Methods (3)
GEOG 5240 - Geography of Knowledge and Information (3)
GEOG 5255 - Applied Population Analysis (3)
GEOG 5260 - Transportation Policy Formulation (3)
GEOG 5265 - Transportation Analysis Methods (3)
GEOG 6000 - Topics in Urban and Regional Analysis (3)
GEOG 6015 - Topics in Regional Geography (3)
GEOG 6030 - Topics in Geographic Techniques (3)
GEOG 6103 - Real Estate Development (3)
GEOG 6105 - Applied Real Estate Development (3)
GEOG 6123 - The Urban Region (3)
GEOG 6210 - The Restructuring City (3)
GEOG 6211 - Cities and Immigrants (3)
GEOG 6212 - Urban Labor Markets (3)
GEOG 6300 - Applied Regional Analysis (3)
GEOG 6301 - Industrial Location (3)
GEOG 6302 - Regional Economic Development (3)
GEOG 6305 - Site Feasibility Analysis (3)
GEOG 6306 - Store Location Research (3)
GEOG 6408 - Spatial Optimization (3)
GEOG 6500 - Urban Planning: Theory and Practice (3)
GRAD 6104 - Spatial Statistics (3)

Urban Planning

Professional planners use information strategically to help communities improve long-term health, safety, prosperity, and social equity. The core curriculum of the Urban Planning concentration provides students with theoretical and practical knowledge that they can complement with elective courses related to economic development, ecological conservation, social justice, land use policy, urban design, and transportation. Individual students' interests and career goals further define capstone research projects that may incorporate economic, social, environmental, or geospatial modeling. The required capstone research frequently involves community-based scholarship that yields mutually beneficial partnerships outside the university. Knowledge, skills, and methods gained from the Urban Planning concentration afford students with opportunities for successful careers in public and private planning organizations. The concentration also prepares students for doctoral studies in planning, geography, policy studies, and related fields. Students with appropriate backgrounds may pursue a dual degree combining the M.A. in Geography (Urban Planning Concentration) and a Master of Urban Design.

Required Courses

GEOG 5210 - Urban Planning Methods (3)
GEOG 6216 - Planning for Urban Sustainability (3)
GEOG 6500 - Urban Planning: Theory and Practice (3)
GEOG 6501 - Community Planning Workshop (3)

Elective Courses

ARCH 7103 - Design Studio: Topical (6)
ARCH 7104 - Design Studio: Diploma Project (6)
GEOG 5209 - Small Town Planning (3)
GEOG 5255 - Applied Population Analysis (3)
GEOG 5260 - Transportation Policy Formulation (3)
GEOG 5265 - Transportation Analysis Methods (3)
GEOG 6103 - Real Estate Development (3)
GEOG 6305 - Site Feasibility Analysis (3)
GEOG 6306 - Store Location Research (3)
MPAD 6102 - Foundations in Public Administration (3)
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6131 - Public Budgeting and Finance (3)

Degree Total = 36 Credit Hours

Advising

Upon admission to the program each student will be assigned a faculty advisor from the student's declared area of interest. This advisor will help guide the student through the design and implementation of a program of study

tailored to the student's specific needs and career goals. The advisor will be available to the student for advice on academic and other matters. Students must confer with their advisors regularly concerning academic matters.

More often than not, students will not work with the same advisor throughout the entire program. Once the student has become familiar with the program and the faculty, it is possible to change advisors by obtaining prior approval from the faculty member with whom the student wishes to work. Advisors should be chosen to match, as nearly as possible, the student's academic and career interests. No student will be allowed to register for a course without an advising session with their advisor. The advisor will remove the advising hold at this session.

All students are required to formulate a complete plan for their M.A. during pre-registration for second semester. This plan must be approved by their advisor and will serve as a guide to their course of study while at UNC Charlotte.

Academic Standards

From the date of admission to graduation, the Department conducts a continuous review of student academic and professional performance. In addition to evaluations conducted within the courses taken by students, the faculty conduct a thorough review of student performance on a regular basis. Continuation in the program is contingent upon a favorable review during these evaluations. Students who consistently show borderline course performance, who are not developing good applied skills in the practice of their chosen area of study, who fail to complete coursework on a timely basis, or who otherwise perform unprofessionally or unsatisfactorily, may be required to complete additional courses or may be terminated from the program.

All graduate students are subject to academic suspension and/or termination. Department academic standards deviate slightly from University policies stated in appropriate catalogs. A student must maintain a cumulative average of 3.0 in all coursework taken in the program. An accumulation of one (1) marginal (C) grade results in the student being placed on probationary status within the program and could lead to the student being required to re-take the course, and a potential loss of funding if the student is receiving departmental or internship funding. An accumulation of two (2) marginal (C) grades results in suspension of the student's enrollment in the graduate program. A graduate student whose enrollment has been suspended because of grades is ineligible to register in any semester or summer session unless properly reinstated through the suspension appeal process. An accumulation of three (3) marginal (C) grades or one (1) unsatisfactory (U) or one (1) NC grade results in termination of the student's enrollment in the graduate program. In order to continue a program of study, the student must pursue reinstatement through the termination appeal process or wait a period of two years before applying for readmission to the program.

Special care should be exercised in completing the requirements of a course in which a grade of Incomplete (I) is received. With the exception of GEOG 6131, where incomplete grades are not normally given, incomplete work must be finished during the next semester in residence, but not later than 12 months after the end of the term in which the "I" was assigned, whichever comes first. However, the course instructor has the option of specifying a completion deadline anytime within the 12-month period. If the "I" is not removed during the specified time, a grade of U is automatically assigned. In any case, a student will not be allowed to schedule the final comprehensive examination until all incomplete grades are removed. Also, with the exception of GEOG 7900, no student may have more than two incomplete grades at any time. Students with two or more incompletes may not register for another term.

Research Options

The program requires all students to complete an individual capstone research project. Although individual research experiences may differ, students should pursue research experiences that are appropriate to departmental faculty resources, individual student's programs and career goals, and the availability of opportunities that exist to work with allied agencies or clients on or off campus. One of three options, depending on the previously stated stipulations, is available: 1) a research experience similar to that of a traditional academic capstone; 2) a research experience which involves a paid internship funded by and arranged with a public or private agency or client; and 3) a research experience involving an internship that is not funded, but arranged with a public or private agency or client.

Each of these options fulfills program requirements equally. Each produces a finished research effort of thesis quality. These options provide a choice for students to pursue a research problem in a direction of their individual interest. In all cases, students must work closely with their advisor and program committee to choose the option which best fits both their particular program and prevailing circumstances.

Not every student can expect to engage in a capstone research project that is a paid internship because the number of students frequently exceeds a matching number of opportunities funded in that manner. Unpaid internships provide the same caliber of experience and training in an applied environment. In some cases, that experience may relate student with nonprofit agencies or social services that simply do not have the resources to fund an internship. In either case, the topic of the internship is defined by the client's problem or needs.

Committees

All GEOG 7900 Research Projects are evaluated by a committee of faculty. Committees must have a minimum of three members composed of the graduate faculty of the department--or related departments. Committee members may include outside members from other departments or internship coordinators from off-campus agencies when appropriate.

Proposal and Capstone Defense

To complete the program, all students are required to pass an oral defense of both the proposal and the final version of their individual capstone project. It is the responsibility of the advisor or committee chair, in consultation with the student, to arrange both proposal and capstone defense.

The Proposal

Students must prepare and orally present a written research proposal that clearly outlines the purpose and scope of their research. Students should be prepared to respond to questions from their research committee, including questions on general topics addressed in their prior coursework. The proposal presentation is generally completed at the beginning (or during) the 3rd semester for full-time students.

The Defense

The defense of the individual research project (GEOG 7900), the capstone, is generally administered at the discretion of the committee chair and the student. When the advisor is satisfied that the student's research and writing has progressed sufficiently, the research document is provided to the other members of the independent research committee; if they agree that the document is ready for a defense, an oral exam is scheduled.

M.S. in Earth Sciences

The Department of Geography and Earth Sciences offers a Master of Science in Earth Sciences degree with opportunities for study and research in the areas of geology, hydrology, atmospheric science, surface processes, environmental science, remote sensing, and geospatial analysis. Graduate students have access to faculty with a broad range of expertise, as well as access to extensive field, laboratory, and computing facilities.

Earth Sciences faculty offer courses and are active in research areas that include surface and groundwater hydrology, vadose zone processes, geochemistry, igneous and metamorphic petrology, biogeochemistry, mineralogy, structural geology, applied geophysics, remote sensing, soil science, Quaternary geology, geomorphology, fluvial processes, depositional environments, biodiversity, landscape ecology, urban ecology, sustainability, forestry, clastic and carbonate sedimentology, basin analysis, stratigraphy, coastal geology, paleoecology, macro- and micropaleontology, environmental geology, applied climatology, global fire modeling, biogeophysical modeling, climate model evaluation, terrestrial carbon cycling, aerosol physics and chemistry, air quality, renewable energies, numerical weather prediction, severe weather, tropical meteorology, and environmental epidemiology.

The program is designed to address a range of student needs and can be completed in two years of full-time study or on a part-time basis. Students choose one of two options with different degree requirements: 1) a course-only option that emphasizes the core knowledge and skills necessary for practice in Earth Sciences professions, or 2) a research option in which students engage in original Earth Sciences research in collaboration with a faculty advisor and complete coursework centered on that research.

Graduates of the course-only option will be prepared for careers such as environmental consultants, geologists in the energy and mining industries, regulators and applied practitioners in some government agencies, and Earth Sciences teachers in secondary schools. The research option prepares students for these careers as well as careers in research labs or most government agencies, and for admission to traditional Geology, Atmospheric, Earth, and Environmental Sciences Ph.D. programs and interdisciplinary Ph.D. programs such as Infrastructure and Environmental Systems.

Admission Requirements

All applications for admission are reviewed by the Department of Geography and Earth Science's Graduate Advisory Committee. The department admits applicants on a competitive basis as space in the program allows. In addition to Graduate School admission requirements, the following are required for the program:

- *Grade Point Average (GPA):* The department expects an overall undergraduate GPA of at least 3.0 on a 4.0 point scale. However, exceptions may be made if other elements of the application are strong.
- *Reference Letters:* Three letters of reference are required. Letters from college or university instructors who have worked with or taught applicants are preferred. These letters are evaluated on the basis of how well the applicant is suited in terms of intellect, preparation, maturity, and motivation to perform graduate work.
- *Personal Statement:* Applicants must write a personal statement that directly addresses their reasons for conducting graduate work, as well as their desire to participate in the M.S. in Earth Sciences program at UNC Charlotte. Applicants should comment on their expectations regarding the benefits of a M.S. and how the program at UNC Charlotte fits their career

and professional goals. Applicants to the research option of the program should identify potential advisors with whom they would like to work and explain why those advisors were selected. Applicants are strongly encouraged to contact potential advisors prior to submitting an application.

- *Scores on the Graduate Record Exam (GRE):* In general, the department expects applicants to score above the 50th percentile on each exam section with a minimum score of 300 on the combined verbal and quantitative portions (equivalent to a minimum combined score of 1000 if taken before 2011). Lower scores will not automatically exclude applicants if the remainder of the applicant's file is strong.
- *Transcripts of College Coursework:* Transcripts of all previous college study must be submitted. They are evaluated on the basis of performance across a range of Earth and environmental sciences, physical sciences, and mathematics courses in order to determine the applicant's preparation for graduate level coursework.
- *Language Requirements:* International applicants whose native language is not English must earn a total score of at least 83 (Internet-based) or 557 (paper-based) on the Test of English as a Foreign Language Exam (TOEFL). This requirement does not apply to U.S. citizens or native English speakers.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Additional Prerequisite Requirements

(Minimum requirements in addition to those enforced by the Graduate School)

All prospective graduate students must demonstrate competence in undergraduate subject matter in their area of study. While the department does not require that applicants' bachelor's degree be in Earth Sciences or a related field, prospective graduate students should provide evidence that they are academically prepared to participate in graduate level coursework in disciplines encompassed by the M.S. in Earth Sciences program at UNC Charlotte.

Students applying to the program should, at a minimum, be familiar with the concepts and materials offered in introductory courses including: Physical Geography or Physical Geology, Chemistry I, Physics I, and calculus-based Mathematics.

Students entering the program with notable deficiencies may be required to complete undergraduate level courses to address those deficiencies in addition to graduate level courses required by the program. The required deficiency courses are mandated at the discretion of the advisor or the Graduate Program Director; these courses typically do not supply graduate credit nor count towards required credits for the M.S. in Earth Sciences program.

All decisions concerning the equivalency of courses in an applicant's transcript to those listed as minimum requirements for entry to the M.S. in Earth Sciences are the responsibility of the Graduate Program Director.

Degree Requirements

The M.S. in Earth Sciences program requires a minimum of 30 credit hours of graduate coursework. Students must choose one of two options to complete the program: 1) a course-only option, or 2) a research option.

Course-Only Option

Students must complete 13-16 credit hours of required coursework that includes a graduate seminar and courses that span the department's areas of expertise in Earth Sciences. The remaining credit hours consist of 5000- or 6000-level elective courses of the student's choosing.

Required Courses (13-16 credit hours)

Graduate Seminar (2 credit hours)

Students take this seminar twice for a total of two credit hours:

ESCI 6600 - Earth Sciences Graduate Seminar (1)

Advanced Subject Matter Courses (6 credit hours)

Select two of the following that cover advanced subject matter related to Earth Sciences:

ESCI 6202 - Earth Systems Analysis: Biogeochemical Cycles (3)
ESCI 6222 - Quaternary Paleoenvironmental Sciences (3)
ESCI 6226 - Landscape Ecology (3)
ESCI 6227 - Ecosystem Restoration (3)
GEOL 6101 - Earth Systems Analysis: Geodynamics (3)
GEOL 6102 - Earth Systems Analysis: Paleoenvironments (3)

Advanced Techniques Courses (5-8 credit hours)

Select two of the following that cover advanced techniques employed by Earth scientists:

ESCI 6105 - Landscape Assessment (4)
ESCI 6120 - Numerical Modeling of the Earth System (3)
ESCI 6229 - Geochemical Tracers and Hydrologic Applications (3)
GEOG 6125 - Geographic Information Science and Technology (4)
GRAD 6101 - Linear Regression (3)
GRAD 6340 - Data Analysis and Presentation for Impact (2)

Elective Courses (14-17 credit hours)
Select from the following courses within the Department of Geography and Earth Sciences:
ESCI 5XXX-6XXX - Earth Sciences Elective
GEOG 5XXX-6XXX - Geography Elective
GEOL 5XXX-6XXX - Geology Elective

It is anticipated that students primarily select courses from the Department of Geography and Earth Sciences, but they may also choose coursework in biology, chemistry, computer science, engineering, mathematics, and physics in support of particular emphases within the program. For example, certain geo-technology or environmental engineering courses in the Department of Civil and Environmental Engineering may be appropriate for the student pursuing problems in environmental Earth Sciences. Students examining the interaction of geology and the biosphere may include Ecology or Botany courses in the Department of Biological Sciences or Organic Chemistry courses in the Department of Chemistry in their program of study. Students must meet other departments' course prerequisite requirements or receive permission from the instructor before registering for out-of-department courses. Up to 6 credit hours of independent study may be applied as elective coursework.

Comprehensive Examination
To complete the program, each course-only option M.S. student must pass a written comprehensive examination testing the student's knowledge and understanding gained in required and elective coursework. The student must respond to three questions of the Graduate Program Director's choosing, each covering material from a different course (both required and elective courses are eligible) in the student's program of study. The written comprehensive exam is normally taken during the penultimate semester and in no case should the student take this exam before accumulating 21 credit hours of completed or in-progress coursework. This exam may not be administered if the student has outstanding Incomplete grades in any coursework. If a student does not successfully answer any question(s) on the exam, the student may retake the question(s) one time in the final semester.

Degree Total = 30 Credit Hours

Research Option
The 30 credit hour minimum for the research option includes 2 credit hours of ESCI 6600, at least 9 credit hours of ESCI 6900, and at least 9 credit hours of 5000- or 6000-level course credits exclusive of ESCI 5800, ESCI 6800, GEOG 6800, and GEOL 6800. The total degree hours must consist of at least 18 credit hours at the 6000 level, including ESCI 6600 and ESCI 6900. *Note: Additional credit hours of ESCI 6900 beyond the required 9 credit hours may be applied.*

Required Courses (11 credit hours)
ESCI 6600 - Earth Sciences Graduate Seminar (1) *(taken twice for a total of 2 credit hours)*
ESCI 6900 - Earth Sciences Research (1 to 9) *(taken for a total of 9 credit hours)*

Earth Sciences Research
Students can pursue research experiences that are appropriate to individual student's interests and experience, departmental faculty resources, and the availability of opportunities that exist to work with allied agencies or clients on or off campus. The research experience can be in the form of a research project or a thesis. The only difference between the requirements for these two formats is that the thesis must adhere to the deadline and formatting requirements for thesis submission of the UNC Charlotte Graduate School, whereas the project must adhere to the deadline requirements for project completion but is not subject to a formatting review by the Graduate School. Both formats have identical expectations regarding scope, originality, and quality of the work completed. Students wishing to complete a project instead of a thesis must obtain advisor permission to do so.

For both the thesis and project, the student must prepare and orally present a written research proposal that clearly outlines the purpose and scope of their research. At the presentation, students should be prepared to respond to questions from their research committee, including questions on general topics addressed in their prior coursework. It is expected that the proposal presentation occur by the end of the second semester for full-time students, and must be completed no later than the end of the third semester for full-time students. The proposal presentation may not occur in the same semester as the defense of the final research document. If the proposal presentation is not completed by the end of the third semester for full-time students, the student is strongly encouraged to transfer to the course-only option (any research credits already taken may be graded by the instructor and applied towards the course-only option as elective credits).

The final results of all research projects and theses must be presented in a written research document. The research document must be formally reviewed and approved by a majority vote of the student's research committee. Research projects and theses must also be orally defended (see below).
Committee

All research proposals and final projects and theses are evaluated by a faculty committee known as the research committee. Research committees must have a minimum

of three members composed of the graduate faculty of the Department or associated departments. Additional members are acceptable and in many cases outside members, such as internship coordinators from off-campus agencies, are advisable.

Defense of the Research Project or Thesis
When the advisor is satisfied that the student's research and writing have progressed sufficiently, the research document is provided to the other members of the research committee. If they agree that the document is ready for a defense, an oral defense is scheduled. At least one week prior to the defense, the student must provide a digital version of the research report or thesis to the research committee and place a digital copy in the appropriate public online folder hosted by the Department for review by all interested faculty and students. At the same time, the advisor must formally notify all faculty and students in the Department of the date, time, place, and topic (title with abstract) of the defense.

Elective Courses (19 credit hours)
Select from courses within the Department of Geography and Earth Sciences:

ESCI 5XXX-6XXX - Earth Sciences Elective
GEOG 5XXX-6XXX - Geography Elective
GEOL 5XXX-6XXX - Geology Elective

It is anticipated that students primarily select courses from the Department of Geography and Earth Sciences, but they may also choose coursework from biology, chemistry, computer science, engineering, mathematics, and physics in support of particular emphases within the program. For example, certain geo-technology or environmental engineering courses in the Department of Civil and Environmental Engineering may be appropriate for the student pursuing problems in environmental Earth Sciences. Students examining the interaction of geology and the biosphere may include Ecology or Botany courses in the Department of Biological Sciences or Organic Chemistry courses in the Department of Chemistry in their program of study. Students must meet other departments' course prerequisite requirements or receive permission from the instructor before registering for out-of-department coursework.

Degree Total = 30 Credit Hours

Grade Requirements
Students are expected to achieve grades of A or B in all coursework taken for graduate credit and must have at least an average of B (3.0) in order to graduate. An accumulation of more than two grades of C results in suspension of the student's enrollment in the graduate program. A grade of U results in the immediate suspension of the student's enrollment in the graduate program. Readmission to the program requires approval of the Graduate Program Director, Department Chair, and Dean of the Graduate School.

Advising
A student's advisor guides the student through the design and implementation of a program of study and research, if applicable, tailored to the student's specific needs and career goals and the Department's research and teaching missions. The advisor generally is available to the student for advice on academic and other problems, and the advisor sets expectations for student performance beyond coursework. Course-only option students are advised by the Graduate Program Director, whereas an advisor is assigned by the Graduate Program Director to each research option student at the time of their admission into the program. Every effort is made to match research option students with advisors who have similar research interests. Research option students may change advisors by obtaining advance permission from the faculty member with whom they wish to work, i.e., the new advisor. No student will be allowed to register for courses without permission of their advisor.

Assistantships
Assistantships may be offered to research option students. Assistantships are much like a part-time job, offering valuable training opportunities and work experience that ideally fit the student's academic interest. The nature of a research assistantship depends entirely on the needs of the Department of Geography and Earth Sciences or supervising faculty member. Teaching assistantships are assigned on the basis of the student's academic background.

Graduate assistantships are arranged for either one entire semester or for an entire academic year (two semesters or nine months). They are normally scheduled for 16 weeks per semester and the student is expected to work 20 hours per week. The department makes every effort to provide funding to every full-time research option student in the program.

Graduate Coursework
The M.S. in Earth Sciences graduate program generally follows a traditional numbering scheme with 5000- and 6000-level courses. The 5000-level numbers identify courses that cover accepted bodies of knowledge within the Earth Sciences with the emphasis placed on mastery and critical assessment of the theoretical and empirical foundations within the discipline. The 6000-level courses are divisible into three categories. (1) The first category is the Earth Systems topic courses, wherein graduate students review and analyze the dominant current working hypotheses that drive contemporary research within conceptual areas such as geodynamics, global biogeochemical cycles, climate change, severe weather

dynamics, or urban ecology. (2) The second 6000-level category is the common core seminar course, wherein graduate students discuss holistic themes and discipline-specific issues in the Earth Sciences over the course of two separate fall semesters. (3) The third 6000-level category is the directed research course that provides the framework for research option students to complete the research requirements within their course of study.

Plan of Study

All students are required to formulate a complete plan for their M.S. before completion of the second semester for full-time students. For course-only option students, this plan includes all coursework that will be completed during the degree. For research option students, the plan of study includes the names of the student's research committee members, a thesis/research project title, the semesters during which the proposal and final defenses are planned, and all coursework that will be completed during the degree. The plan of study must be approved by the Graduate Program Director and all committee members (research option students only), and serves as a guide to coursework and research while at UNC Charlotte.

Transfer Credit

Up to 6 graduate credit hours may be accepted as transfer credit. Only courses with grades of A or B earned at an accredited university are eligible. Transfer credits are not automatic and require the approval of the Graduate Program Director and the Graduate School. The amount of transfer credit may not exceed the limit set by the Graduate School (6 credit hours).

Graduate Certificate in Geographic Information Science and Technology

The Graduate Certificate in Geographic Information Science and Technology (GIS&T) program provides students in-depth training and education in GIS. Students with different backgrounds (e.g., biology/ecology, geography, earth sciences, meteorology, engineering, social science, public health, and computer science) are exposed to knowledge in cutting-edge geospatial theory, methods, and technologies, including GIS, spatial analysis, remote sensing, cartography, and geovisualization. Students develop geospatial skills that are of great help in their domain-specific problem-solving using state-of-the-art GIS. The GIS training that students receive from the graduate certificate program makes them highly competitive in their future careers in academic or industrial fields.

Admission Requirements

The certificate program is open to all applicants who either hold a bachelor's degree from a college or university accredited by an accepted accrediting body or are enrolled and in good standing in a graduate degree program at UNC Charlotte. Applications for admission are considered as they are received, and admissions are ongoing. All students are admitted to the Graduate School in a special category for certificate programs. Students currently enrolled in the M.A. in Geography program within the Department of Geography and Earth Sciences are also eligible to apply for the certificate.

To apply for the admission to the certificate program, applicants are required to submit:

- A completed Graduate Admissions application form to Graduate Admissions with a statement of professional goals
- Three letters of recommendations from academic or professional sources
- Scores of GRE (and TOEFL for international applicants)
- GPA: In general, the department would prefer an overall undergraduate GPA above 3.0 (or a 3.0 for the last 2 years) on a 4.0 scale. However, averages less than these will not exclude applicants if the other elements of the application are strong
- Official transcripts from all post-secondary educational institutions

Certificate Requirements

At least 13 total credit hours are required to obtain a Certificate in Geographic Information Science and Technology from the Department of Geography and Earth Sciences. Students are required to take the core course which focuses on the fundamentals of GIS&T and then three elective courses from the list below.

Core Course (4 credit hours)

Select one of the following:

GEOG 6125 - Geographic Information Science and Technology (4)
GEOG 8125 - Geographic Information Science and Technology (4)

Elective Courses (9 credit hours)

Select three of the following:

ESCI 5170 - Fundamentals of Remote Sensing (4)
ESCI 5180 - Digital Image Processing in Remote Sensing (4)
GEOG 5103 - Computer Programming for GIS Applications (3)
GEOG 5131 - Environmental Modeling with GIS (4)
GEOG 5132 - Spatial Modeling for Social and Economical Applications (3)
GEOG 5150 - Spatial Database Development with GPS and GIS (3)

GEOG 5180 - Web GIS (3)
GEOG 6000 - Topics in Urban and Regional Analysis - (3)
or GEOG 8000 - Topics in Urban and Regional Analysis - (3)
GEOG 6030 - Topics in Geographic Techniques (3)
or GEOG 8030 - Topics in Geographic Techniques (3)
GEOG 6182 - Agent-Based Modeling of Coupled Human and Natural Systems (3)
GEOG 6205 - Geovisualization (3)
or GEOG 8205 - Geovisualization (3)
GEOG 6282 - CyberGIS and Big Data (3)
or GEOG 8282 - CyberGIS and Big Data (3)
GEOG 6406 - Spatial Information and Mobility (4)
GEOG 6407 - Geocomputation (3)
or GEOG 8407 - Geocomputation (3)
GEOG 6408 - Spatial Optimization (3)
or GEOG 8408 - Spatial Optimization (3)
GRAD 6104 - Spatial Statistics (3)
or GRAD 8104 - Spatial Statistics (3)

Certificate Total = 13 Credit Hours

Grade Requirements

Students must earn a grade of C or above in all courses toward the certificate.

GERONTOLOGY

- Graduate Certificate in Gerontology

Gerontology Program

gerontology.charlotte.edu

Graduate Certificate in Gerontology

The Graduate Certificate in Gerontology is designed to provide graduate education in Gerontology for those who already have a graduate degree in another field, those currently completing a graduate degree in another field, who are interested in working with older adults, and others seeking a credential to work in the aging field. It requires completion of a foundational class, followed by one elective from each elective track. A 150-hour practicum experience is also available for students who desire this opportunity, but does not count towards the 12 credit hours required to graduate with the certificate.

Admission Requirements

In addition to the general requirements for admission to a certificate program, applicants must provide:

- Official transcripts of all baccalaureate and graduate work attempted
- Two letters of recommendation from persons familiar with the applicant's professional and personal qualifications; these letters may be waived if the student is already enrolled in a master's or doctoral program
- An essay describing the applicant's relevant experience and objectives in undertaking graduate study in Gerontology
- A resume

Applications for admission to the Graduate Certificate in Gerontology program are considered as they are received, and admissions are ongoing. Students are admitted to the Graduate School in a special category for certificate students.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate certificate before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

The Graduate Certificate Program requires completion of a minimum of 12 credit hours of graduate coursework related to aging and older adults.

Core Course (3 credit hours)

This course provides a foundational and interdisciplinary understanding of aging and older adults.

GRNT 6600 - Current Issues in the Diverse Experiences of Aging (3)

Elective Courses (9 credit hours)

Select one course from each of the following tracks*.

Social Science Course (3 credit hours)

Select one of the following:

GRNT 5150 - Older Individual and Society (3)
or SOCY 5150 - Older Individual and Society (3)
GRNT 5270 - Intergenerational Relationships and Programs (3)
GRNT 5290 - The Experience of Loneliness (3)
or SOCY 5290 - The Experience of Loneliness (3)
GRNT 5353 - Environments for Aging (3)
GRNT 6124 - Psychology of Aging (3)
or PSYC 6124 - Psychology of Aging (3)
GRNT 6130 - Sociology of Aging: Theories and Research (3)
or SOCY 6130 - Sociology of Aging: Theories and Research (3)
GRNT 6134 - Family Caregiving Across the Lifespan: Theory, Practice, and Policy (3)
or SOCY 6134 - Family Caregiving Across the Lifespan: Theory, Practice, and Policy (3)
or SOWK 6134 - Family Caregiving Across the Lifespan: Theory, Research, and Policy (3)
SOCY 6112 - The Sociology of Work (3)
SOWK 5101 - Social Work Practice with Older Adults and Families (3)

Health Science Course (3 credit hours)

Select one of the following:

GRNT 5260 - Women: Middle Age and Beyond (3)
GRNT 5280 - The Experience of Dementia (3)
GRNT 5365 - Grief and Loss Across the Lifespan (3)
or SOWK 5365 - Grief and Loss over the Lifespan (3)
GRNT 6275 - Health Promotion, Nutrition, and Wellness for Older Adults (3)
CSLG 6205 - Counseling Older Adults (3)
CSLG 7681 - Grief and Loss Counseling (3)
KNES 5232 - Physiology of Human Aging (3)
NURS 6275 - Health Promotion, Nutrition, and Wellness for Older Adults (3)

Administration Course (3 credit hours)

Select one of the following:

GRNT 5250 - Aging Programs and Services (3)
GRNT 6210 - Aging and Public Policy (3)
GRNT 6211 - Administration of Aging Programs (3)
ADMN 6101 - Perspectives on Adult Learning Theory (3)
HADM 6100 - Introduction to the U.S. Healthcare System (3)
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6172 - Administration of the Healthcare Systems in the United States (3)
MPAD 6210 - Aging and Public Policy (3)
MPAD 6211 - Administration of Aging Programs (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)

**Note: With approval of the Gerontology Graduate Program Director, topics courses may fulfill elective track courses depending upon their individual focus. The Graduate Program Director will make this determination each semester.*

GRNT 5050 - Topics in Gerontology (1 to 4)
GRNT 6050 - Topics in Gerontology (3)

Optional Course

The following optional course is available to all students in the Graduate Certificate in Gerontology program. However, it does not count toward the 12 credit hours required for graduation.

GRNT 6400 - Practicum (3)

Certificate Total = 12 Credit Hours

Transfer Credit

Credit hours taken at other institutions cannot transfer into the Graduate Certificate in Gerontology program. Only UNC Charlotte credit hours may be used to transfer into the Graduate Certificate in Gerontology program.

HEALTH PSYCHOLOGY

- Ph.D. in Health Psychology
  - Clinical Health
  - Community Health
  - General Health

Graduate Program
healthpsych.charlotte.edu

Ph.D. in Health Psychology

Health Psychology is dedicated to conducting basic and applied research examining the contribution of biological, psychological, behavioral, social, cultural, and environmental factors to health and illness.

Health Psychology builds from principles and theories of other areas of psychology, biology, health, and social sciences. Health psychologists are concerned with promotion and maintenance of health, the prevention and treatment of illness across the lifespan, and improvement of systems that promote and maintain health.

A particular emphasis of the Health Psychology program is on the development, implementation, and evaluation of prevention and treatment interventions that involve multiple disciplines. The program has links with other colleges, departments, and programs in the University including the College of Health and Human Services, College of Education, and the Gerontology Program which allows students to select health courses across disciplines.

The Health Psychology doctoral program at UNC Charlotte offers students an opportunity to obtain their Ph.D. in Health Psychology in one of three concentrations: General, Clinical, or Community.

Admission Requirements
Applicants are expected to have a minimum of 18 credit hours of coursework in psychology, including Introductory Psychology and Research Methods, coursework in undergraduate statistics, excellent scores on the GRE Exam, and an excellent academic track record as demonstrated by undergraduate or graduate grade point averages.

Additionally, students who succeed in the Health Psychology program are hardworking, competent, disciplined scholars with interests in the science of Health Psychology and other health-related fields. Students must demonstrate intellectual curiosity and a passion for the science of psychology. It is important for student applicants to determine if their professional interests are well matched to the expertise of our faculty members.

Documents to be Submitted for Application for Admission
Applicants are expected to complete an application online to the Graduate School. The application also must include transcripts of all completed academic work, an official score on the GRE exam, three letters of reference from persons, preferably psychologists, who can speak to the applicant's promise as a doctoral student, a two page statement of professional goals and research interests, and a current resume or CV. International students must submit official TOEFL or IELTS test scores. Minimum score required for the TOEFL: of at least 557 on the written test or 83 on the computer-based test. Minimum overall band score required for the IELTS is 6.5. All tests must be taken within the last two years.

Admission Assessment
Admissions reviews are conducted by faculty in each concentration. The deadline for all application materials is November 15. Review of applications typically occurs in January, interviews in February, and admissions offers typically made in March.

Degree Requirements
For the General and Community concentrations, 75 and 78 credit hours (post-baccalaureate), respectively, are required. All coursework taken at UNC Charlotte that counts toward the Ph.D. is at the 6000 level or above. The majority of the coursework is at the 8000 level. For the Clinical Health concentration, which enables students to become eligible for licensure as a Health Services Provider, 85 credit hours (post-baccalaureate) are required.

Each concentration's curriculum has 5 major components:
1) Core Health Psychology
2) Research Methodology and Analytics
3) Concentration (General, Clinical, or Community)
4) Interdisciplinary Content
5) Electives

Specific requirements within each component vary by concentration.

General Concentration (75 credit hours)

Core Health Psychology Courses (12 credit hours)
HPSY 8200 - Health Psychology I (3)
HPSY 8201 - Health Psychology II (3)
HPSY 8243 - Diversity in Health Psychology (3)
PHIL 8240 - Research Ethics in the Biological and Behavioral Sciences (3)

Research Methodology and Analytics Courses (24 credit hours)

HPSY 8102 - Research Design and Quantitative Methods in Psychology (3)
HPSY 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)
HPSY 8262 - Practicum in Health Psychology (3)
HPSY 8899 - Readings and Research in Psychology (1 to 4) *(minimum 1 credit hour and up to 3 credit hours allowed)**
HPSY 8999 - Doctoral Dissertation Research (1 to 9) *(minimum 3 credit hours and up to 9 credit hours allowed)**

** Note: A maximum of 9 credit hours of HPSY 8899 or HPSY 8999 combined are allowed.*

Advanced Methodology Courses

Select two of the following:

HLTH 8221 - Qualitative Research in Behavioral Sciences (3)
HLTH 8222 - Qualitative Research II: Theory Generation and Analysis in Behavioral Sciences (3)
HLTH 8281 - Measurement and Scale Development (3)
HLTH 8282 - Health Survey Design and Research (3)
HLTH 8602 - Communicating and Disseminating Research (1)
HPSY 8104 - Advanced Quantitative Analyses for Behavioral Sciences (3)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
OSCI 8650 - Research Methods Seminar in Organizational Science (3)
PPOL 8665 - Analytic Epidemiology (3)

Concentration Courses (6 credit hours)

HPSY 8601 - Foundations in Psychology I: Physiological, Cognitive, and Affective Basis of Human Behavior (3)
HPSY 8602 - Foundations in Psychology II: Developmental, Community, and Social Basis of Behavior (3)

Interdisciplinary Courses (15 credit hours)

Select five of the following:

COMM 6000 - Topics in Communication Studies (3) *(Narratives of Health and Illness; Gendered Bodies; Interpersonal Process in Health Contexts)*
GRNT 6210 - Aging and Public Policy (3)
or MPAD 6210 - Aging and Public Policy (3)
GRNT 6600 - Current Issues in the Diverse Experiences of Aging (3)
HLTH 6227 - Community Health Planning and Evaluation (3)
HLTH 8220 - Theories and Interventions in Behavioral Science (3)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
HPSY 8155 - Community Psychology (3)
HPSY 8255 - Community Interventions (3)
HPSY 8455 - Practicum in Community Psychology (1 to 3)
HSRD 8000 - Topics in Health Services Research (1 to 4)
HSRD 8202 - Healthcare Systems and Delivery (3)
HSRD 8203 - Economics of Health and Healthcare (3)
or PPOL 8667 - Economic of Health and Healthcare (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)
NUDN 8202 - Community Epidemiology (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
PPOL 8661 - Social Organization of Healthcare (3)
PPOL 8663 - Health Policy (3)
SOCY 6090 - Topics in Sociology (3)

Elective Courses (18 credit hours)

Select six courses from the following:

HPSY 8260 - Topics in Health Psychology (3) *(Mindfulness)*
PSYC 6111 - Psychology of Learning and Memory (3)
PSYC 6113 - Physiological Psychology (3)
PSYC 6115 - Sensation and Perception (3)
PSYC 6116 - Cognition (3)
PSYC 6124 - Psychology of Aging (3)
PSYC 6130 - Social Psychology (3)
PSYC 6135 - Psychology of Personality (3)
PSYC 6216 - Introduction to Cognitive Science (3)
PSYC 6999 - Thesis *(up to 6 credit hours allowed) (if student is co-enrolled in an M.A. in Psychology program)*

Clinical Health Concentration (85 credit hours)

Core Health Psychology Courses (12 credit hours)

HPSY 8107 - Ethical and Professional Issues in Psychology (3)
HPSY 8200 - Health Psychology I (3)
HPSY 8201 - Health Psychology II (3)
HPSY 8243 - Diversity in Health Psychology (3)

Research Methodology and Analytics Courses (21 credit hours)

HLTH 8281 - Measurement and Scale Development (3)
HPSY 8102 - Research Design and Quantitative Methods in Psychology (3)
HPSY 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)
HPSY 8899 - Readings and Research in Psychology (1 to 4) *(minimum 1 credit hour and up to 3 credit hours allowed)***
HPSY 8999 - Doctoral Dissertation Research (1 to 9) *(minimum 3 credit hours and up to 9 credit hours allowed)***
OSCI 8650 - Research Methods Seminar in Organizational Science (3)

*** Note: A maximum of 9 credit hours of HPSY 8899 or HPSY 8999 combined are allowed.*

Advanced Methodology Course
Select one of the following:
HLTH 8221 - Qualitative Research I: Theory Generation in Behavioral Sciences (3)
HLTH 8222 - Qualitative Research II: Theory Generation and Analysis in Behavioral Sciences (3)
HLTH 8282 - Health Survey Design and Research (3)
HLTH 8602 - Communicating and Disseminating Research (3)
HPSY 8104 - Advanced Quantitative Analyses for Behavioral Sciences (3)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
PPOL 8000 - Topics in Public Policy (3) *(Categorical Data Analyses)*
PPOL 8665 - Analytical Epidemiology (3)

Concentration Courses (43 credit hours)
Clinical Courses (37 credit hours)
HPSY 8050 - Topics in Psychological Treatment (3)
HPSY 8141 - Intellectual Assessment (4)
HPSY 8142 - Personality Assessment (4)
HPSY 8150 - Introduction to Psychological Treatment (4)
HPSY 8151 - Behavior Disorders (4)
HPSY 8240 - History and Systems of Psychology (3)
HPSY 8245 - Clinical Supervision and Consultation in Psychology (3)
HPSY 8450 - Practicum in Clinical Psychology (1 to 3) *(12 credit hours; at least 6 credit hours to be completed in residence in the program)*
HPSY 8950 - Internship (0)

Breadth Courses (6 credit hours)
HPSY 8601 - Foundations in Psychology I: Physiological, Cognitive, and Affective Basis of Human Behavior (3)
HPSY 8602 - Foundations in Psychology II: Developmental, Community, and Social Basis of Behavior (3)

Interdisciplinary Courses (9 credit hours)
Select three of the following:
COMM 6000 - Topics in Communication Studies (3) *(Narratives of Health and Illness)*
GRNT 6210 - Aging and Public Policy (3)
or MPAD 6210 Aging and Public Policy (3)
GRNT 6600 - Current Issues in the Diverse Experiences of Aging (3)
HLTH 6201 - Social and Behavioral Foundations of Public Health (3)
HLTH 6207 - Community Health Planning and Evaluation (3)
HLTH 6221 - Community Health (3)
HLTH 8220 - Theories and Interventions in Behavioral Sciences (3)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
HPSY 8155 - Community Psychology (3)
HPSY 8255 - Community Interventions (3)
HPSY 8455 - Practicum in Community Psychology (3)
HSRD 8000 - Topics in Health Services Research (3)
HSRD 8202 - Healthcare Systems and Delivery (3)
HSRD 8203 - Economics of Health and Healthcare (3)
or PPOL 8667 - Economics of Health and Healthcare (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)
NUDN 8202 - Community Epidemiology (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
PPOL 8661 - Social Organization of Healthcare (3)
PPOL 8663 - Health Policy (3)
SOCY 6090 - Topics in Sociology (3)

Community Concentration (78 credit hours)

Core Health Psychology Courses (12 credit hours)
HPSY 8200 - Health Psychology I (3)
HPSY 8201 - Health Psychology II (3)
HPSY 8243 - Diversity in Health Psychology (3)
PHIL 8240 - Research Ethics in the Biological and Behavioral Sciences (3)

Research Methodology and Analytics Courses (18 credit hours)
HPSY 8102 - Research Methodologies in Behavioral Sciences (3)
HPSY 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)
HPSY 8455 - Practicum in Community Psychology (1 to 3)
or PSYC 8355 - Community Research Practicum (3)
HPSY 8899 - Readings and Research in Psychology (1 to 4) *(minimum 1 credit hour and up to 3 credit hours allowed)**
HPSY 8999 - Doctoral Dissertation Research (1 to 9) *(minimum 3 credit hours and up to 9 credit hours allowed)**

*** Note: A maximum of 9 credit hours of HPSY 8899 or HPSY 8999 combined are allowed.*

Advanced Methodology Course
Select one of the following:
HLTH 8221 - Qualitative Research I: Theory Generation in Behavioral Sciences (3)
HLTH 8222 - Qualitative Research II: Theory Generation and Analysis in Behavioral Sciences (3)
HLTH 8282 - Health Survey Design and Research (3)
HLTH 8602 - Communicating and Disseminating Research (3)
HPSY 8099 - Topics in Psychology (3) *(Measurement and Scale Development)*
or HLTH 8281 - Measurement and Scale Development (3)
HPSY 8104 - Advanced Quantitative Analyses for Behavioral Sciences (3)
PPOL 8000 - Topics in Public Policy (3) *(Categorical Data Analyses)*

PPOL 8665 - Analytical Epidemiology (3)

Concentration Courses (15 credit hours)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
HPSY 8155 - Community Psychology (3)
HPSY 8255 - Community Interventions (3)
HPSY 8455 - Practicum in Community Psychology (1 to 3) ****
or PSYC 8355 - Community Research Practicum (3) ****

*****A total of 6 credit hours of practicum are required.*

Interdisciplinary Courses (18 credit hours)
Select six of the following:
COMM 6000 - Topics in Communication Studies (3) *(Narratives of Health and Illness)*
GRNT 6210 - Aging and Public Policy (3)
or MPAD 6210 Aging and Public Policy (3)
GRNT 6600 - Current Issues in the Diverse Experiences of Aging (3)
HLTH 6201 - Social and Behavioral Foundations of Public Health (3)
HLTH 6207 - Community Health Planning and Evaluation (3)
HLTH 6221 - Community Health (3)
HLTH 8220 - Theories and Interventions in Behavioral Sciences (3)
HPSY 8145 - Applied Research Design and Program Evaluation (3)
HPSY 8155 - Community Psychology (3)
HPSY 8255 - Community Interventions (3)
HPSY 8455 - Practicum in Community Psychology (3)
HSRD 8000 - Topics in Health Services Research (3)
HSRD 8202 - Healthcare Systems and Delivery (3)
HSRD 8203 - Economics of Health and Healthcare (3)
or PPOL 8667 - Economics of Health and Healthcare (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)
NUDN 8202 - Community Epidemiology (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
PPOL 8661 - Social Organization of Healthcare (3)
PPOL 8663 - Health Policy (3)
SOCY 6090 - Topics in Sociology (3)

Elective Courses (15 credit hours)
Select five of the following:
HPSY 8099 - Topics in Psychology (3) *(Developmental Psychology)*
HPSY 8260 - Topics in Health Psychology (3) *(Mindfulness)*
HPSY 8601 - Foundations in Psychology I: Physiological, Cognitive, and Affective Basis of Human Behavior (3)
HPSY 8602 - Foundations in Psychology II: Developmental, Community, and Social Basis of Behavior (3)
PSYC 6111 - Psychology of Learning and Memory (3)
PSYC 6113 - Physiological Psychology (3)
PSYC 6115 - Sensation and Perception (3)
PSYC 6116 - Cognition (3)
PSYC 6124 - Psychology of Aging (3)
PSYC 6130 - Social Psychology (3)
PSYC 6135 - Psychology of Personality (3)
PSYC 6216 - Introduction to Cognitive Science (3)
PSYC 6999 - Thesis *(up to 6 credit hours allowed) (if student is co-enrolled in an M.A. in Psychology program)*

Degree Total = 75-85 Credit Hours

Grade Requirements
Graduate students must have a 3.0 GPA in the courses on their degree plan of study in order to graduate. More than two grades of C or one U results in termination from the program.

Plan of Study
Students develop a plan of study with their advising committees.

Admission to Candidacy
After successfully passing the qualifying examination, students must successfully propose and defend a dissertation topic. A student advances to candidacy after the dissertation topic has been approved by the student's doctoral committee. Candidacy must be achieved at least 6 months before the degree is conferred.

Student Advising
Students are assigned an advisor before the first semester. Students in consultation with the advisor create an advising committee constituted by three health psychology faculty. The student meets with the committee regularly for issues of professional development and guidance in the program. Students may change advisors with permission of the Program Director.

Other Requirements
- Master's thesis or second year research project
- Written comprehensive project prior to beginning dissertation research
- Dissertation
- Year-long, pre-doctoral internship (Clinical concentration students only)

Time Limits for Completion
Students are admitted for full-time study only. Students entering the doctoral program post-baccalaureate must complete their degree, including the dissertation, within nine years. Full-time students must meet benchmark requirements each year to maintain their status as a doctoral student. Part-time students also must meet benchmark requirements that occur approximately every

two years. These benchmarks are intended to help students achieve their goal of completing the doctorate in a timely manner. See the *Health Psychology Student Handbook* for a detailed description of the timeline for completing programmatic milestones.

The graduate school has specific requirements that students should be familiar with. Please see the relevant sections of this *Catalog* for specific details.

Second Year Project

The second year project is meant to immerse students in a practical research experience that will help them develop skills to conduct independent research projects. Students are expected to develop and carryout this project under close supervision from their primary academic advisor. A manuscript that follows the format of typical empirical articles in psychology and should be turned into the student's primary advisor and members of their advisory committee.

Comprehensive (Qualifying) Project

Qualifying projects are meant to demonstrate broad competence as a scholar in the disciplines of Health Psychology, interdisciplinary health, and the concentration-specific discipline (General, Clinical, or Community). The Comprehensive Project results in a practical product that demonstrates integration of knowledge from these three areas. In addition, it provides an opportunity to strengthen and develop a student's skills, as specified by their advisory committee. Projects are identified via a collaborative process, involving the student and their committee. The Comprehensive Project acts as the gateway into the 4th year and dissertation. Students must pass their Comprehensive Project successfully to continue in the program.

Each student's advisory committee, in consultation with the Program Director, tailors the content and format of the Comprehensive Project with attention to the student's professional goals. The Comprehensive Project process includes three main components: written project, brief integrative paper, and oral presentation.

Students must complete their second year research projects prior to proposing the comprehensive project, must have at least a 3.0 GPA, must not be on probation, and must have removed any conditions placed upon them at the time at admission. Comprehensive Projects should be in process no later than the third academic year in the program. Comprehensive Projects must be completed successfully before students may rise to doctoral candidacy and propose their dissertation project

Doctoral Committee

The doctoral committee is formed after successful completion of the qualifying project. The student must complete the graduate student petition to create the committee. The committee must include at least three members of the health psychology faculty as well as the Graduate School-appointed Graduate Faculty representative.

Dissertation

The dissertation must be successfully proposed and defended before being undertaken. The major advisor directly supervises the student on the dissertation project with support from the dissertation committee. See Graduate School policies regarding dissertations. Additional information regarding the dissertation project can be found in the *Health Psychology Student Handbook*.

Application for Degree

Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Research Opportunities

Students in health psychology are expected to engage in collaborative and independent research activities. Many opportunities are available through the program, including experience in qualitative and quantitative research methods. Many Health Psychology faculty members engage in grant funded research and opportunities exist for research assistantships.

Transfer Credit

The maximum amount of transfer credit that a Ph.D. student may count towards a doctorate is 30 credit hours. The student's advising committee recommends transfer credits that are consistent with the student's program of study to the Graduate School for approval.

HISTORY

- M.A. in History
  - Public History

Department of History
history.charlotte.edu

M.A. in History

The Master of Arts in History program at UNC Charlotte is designed to give motivated students an opportunity to pursue advanced studies in close collaboration with accomplished scholars. The program emphasizes the development of methodological, literary, and conceptual skills that graduates can employ as students in a doctoral program, as professionally oriented history teachers in secondary schools, as staff at museums or historic sites, or as citizens more acutely aware of the historical evolution of their society. Offering both day and evening courses, the Department of History attracts a diverse group of traditional and non-traditional students. Candidates may pursue the M.A. in History degree on either a full-time or part-time basis.

The Department offers courses in United States, European, and Latin American history, with particular expertise in the following areas:

- African American and Black Women's History
- American South, Old and New
- Colonial and Modern Latin America
- Comparative Slavery, Race and Race Relations, and the African Diaspora
- Early Modern and Modern Europe
- Environment, Labor and Business, Science, Medicine, and Technology
- Military, War, and International Relations
- Nationalism and Colonialism in World History
- Urban History, Immigration, and Ethnicity
- Women's History, Gender, and the Body

The Department also offers a concentration in the field of Public History. The program emphasizes museum studies, historic preservation, and the creation of new media projects such as websites, digital collections, and documentaries.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are ordinarily required for admission to the M.A. in History program:

- A minimum undergraduate GPA of 3.0 in History or a related discipline
- A personal statement outlining the candidate's background, interest, and goals in History
- Three letters of recommendation from former instructors and/or employers
- A writing sample of at least 6-8 pages

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program
Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements
The Master of Arts degree in History requires completion of at least 30 credit hours in approved graduate courses. These courses must include at least 24 credit hours in History, of which at least 15 credit hours are in seminars or colloquia open only to graduate students.

For M.A. thesis students, no more than 6 credit hours of elective courses can be at the 5000-level, in HIST 6984, HIST 6901, or outside the Department of History (in any combination). For M.A. comprehensive exam students, no more than 9 credit hours of elective courses can be at the 5000-level, in HIST 6894, HIST 6901, or outside the Department of History (in any combination).

Students taking the comprehensive examination may take 3 credit hours of exam preparation and students completing a thesis may take 6 credit hours of thesis preparation toward their 30 credit hours.

Students who pursue the Concentration in Public History must complete 30 credit hours of required and elective coursework, 3 credit hours for an internship in some area of Public History, and 3 credit hours of thesis work, for a total of 36 credit hours.

No more than six transferred credit hours may be approved for application to the requirements for the degree.

Students must complete all degree requirements, including the comprehensive examination or thesis defense, within seven calendar years of first enrollment in the program.

Required Courses for the M.A. in History

History Colloquia Courses (9 credit hours)

Select three of the following:

HIST 6001 - Colloquium in United States History Before 1865 (3)
HIST 6002 - Colloquium in United States History Since 1865 (3)
HIST 6101 - Colloquium in 19th-Century European History (3)
HIST 6102 - Colloquium in 20th-Century European History (3)
HIST 6201 - Colloquium in Colonial Latin American History (3)
HIST 6202 - Colloquium in Modern Latin American History (3)

Other Required Courses (6 credit hours)

HIST 6693 - History and Methodology (3) *(to be taken in the Spring, after completion of at least six credit hours)*
HIST 6694 - Seminar in Historical Writing (3) *(to be taken in the Fall of the second year, after completion of HIST 6693)*

Comprehensive Exam or Thesis (3-6 credit hours)

Select one of the following:

HIST 6698 - Exam Preparation (3)
HIST 6999 - Thesis (taken for 6 credit hours)

Required Courses for the M.A. in History with Concentration in Public History

History Colloquia Courses (6 credit hours)

Select two of the following:

HIST 6001 - Colloquium in United States History Before 1865 (3)
HIST 6002 - Colloquium in United States History Since 1865 (3)
HIST 6101 - Colloquium in 19th-Century European History (3)
HIST 6102 - Colloquium in 20th-Century European History (3)
HIST 6201 - Colloquium in Colonial Latin American History (3)
HIST 6202 - Colloquium in Modern Latin American History (3)

Other Required Courses (24 credit hours)

HIST 6300 - Topics in Public History (3) *(or another approved public history elective)*
HIST 6310 - Museum Studies (3)
HIST 6320 - Historic Preservation (3)
HIST 6330 - History in the Digital Age (3)
HIST 6400 - Internship (3)
HIST 6693 - Historiography and Methodology (3)
HIST 6694 - Seminar in Historical Writing (3)
HIST 6999 - Thesis (3)

Consult the department website at history.charlotte.edu for a more detailed description of program requirements and suggested courses of study.

Elective Courses

HIST 5000 - Problems in American History (3)
HIST 5001 - Problems in European History (3)
HIST 5002 - Problems in Non-Western History (3)
HIST 6000 - Topics in History (3)
HIST 6300 - Topics in Public History (3)
HIST 6894 - Readings in History (3)
HIST 6901 - Directed Readings/Research (3)
HIST 6997 - Directed Research (3)

In addition to the above listed courses, all other History courses at the 6000 level may count as an elective, including the colloquia, if students take additional credit hours beyond the already completed requirements. For example, if a student takes four colloquia, the fourth counts as an elective.

Students may also elect to take up to 6 or 9 credit hours of graduate-level coursework in disciplines other than History, depending on whether they pursue the thesis or comprehensive exam, respectively. Candidates seeking graduate-level teacher certification may use the elective option to take courses in professional education selected in consultation with the College of Education. If a student needs more than that number of elective hours to satisfy certification requirements, those hours will be added to the total required for the M.A. in History.

Degree Total = 30 Credit Hours

Grade Requirements

All students in the program are expected to maintain an overall B average (3.0 GPA). Students who do not meet this expectation will be subject to suspension on recommendation of the Graduate Committee of the Department of History.

Advising

Students may not register for graduate-level courses without the permission of the Department of History. Consequently, students must be advised by the Graduate Program Director, either in person or by phone or email,

prior to registering for courses each semester, as well as prior to filing their application for degree.

Language Requirement

Although students are not required to demonstrate proficiency in a foreign language, they are expected to be able to use whatever languages they need to pursue their research interests.

Thesis/Comprehensive Examination

After completing the required courses, students must either prepare a Master's thesis based on original primary research or take three comprehensive written examinations based on reading lists compiled in consultation with faculty members. Students intending to write theses must first write and then defend a thesis proposal. M.A. candidates completing either the thesis or exam must then pass an oral defense of their written work.

An Examining Committee, consisting of two graduate faculty members from the Department of History and a third member selected from History or another department, oversees the student's thesis work or conducts the comprehensive written and oral examinations.

Assistantships

The Department of History currently supports eight students with teaching assistantships, two students with editorial assistantships, and occasionally provides support for other students via administrative assistantships. Assistantships are currently funded at $9,000 per academic year. From time to time, the department also provides students with other employment opportunities.

See the section Financial Assistance below for additional information on resources available to graduate students in the Department of History.

Internships

Internships are available to all students and required for those in the Public History program. Some are available within the department; others with a variety of historical museums and sites.

Financial Aid/Financial Assistance

Students may obtain limited financial support from paid internships, summer or adjunct teaching in the department, archival work in the library's Special Collections, and teaching opportunities at local community colleges. Students doing thesis research or presenting papers at professional conferences may receive modest travel grants from the department or from the Graduate and Professional Student Government.

Information on non-departmental forms of financial assistance is available from the Office of Student Financial Aid.

LANGUAGES AND CULTURE STUDIES

- M.A. in Spanish
  - Language, Literature, and Culture
  - Translation and Interpreting Studies
- Graduate Certificate in Languages and Culture Studies: Business Languages
  - German
  - Spanish
- Graduate Certificate in Languages and Culture Studies: Translating
  - French
  - German
  - Japanese
  - Russian
  - Spanish
- Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies, Spanish-English

Department of Languages and Culture Studies
languages.charlotte.edu

M.A. in Spanish

The Master of Arts in Spanish serves individuals who seek a greater understanding of Spanish language, literatures and cultures, and who seek career and professional advancement opportunities in education, translation, interpreting, applied language (Business Spanish), and who contemplate pursuing a Ph.D. in fields such as Hispanic literature, linguistics, translation and interpreting studies, intercultural communication, or international studies.

The M.A. in Spanish provides a rich variety of graduate coursework in a major world language that is becoming increasingly important in the United States. The program builds on a comprehensive undergraduate curriculum and consists of two concentrations:

1) Language, Literature, and Culture (LLC)
2) Translation and Interpreting Studies (TIS)

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for the M.A. in Spanish:

A baccalaureate degree in Spanish or in a related field that required upper-division coursework in undergraduate Spanish (e.g., Latin American Studies, International Studies, International Business), with an overall GPA of at least 3.0 (on a 4.0 scale)

- **Degree -** A baccalaureate degree in Spanish or in a related field that required upper-division coursework in undergraduate Spanish (e.g., Latin American Studies, International Studies, International Business), with an overall GPA of at least 3.0 (on a 4.0 scale)
- **Essay -** A well-developed essay written in English that addresses the applicant's motivation for enrolling in the M.A. in Spanish, to include particular areas of research interests and career or professional goals
- **Writing Samples -** Students must demonstrate a high level of proficiency in both languages (English and Spanish) by providing writing samples in each language. Students seeking enrollment in the LLC concentration must submit a college term paper or a substantive writing sample (minimum 1,000 words) in Spanish and a second paper written in English. Students seeking enrollment in the TIS concentration may submit translation samples (one from English into Spanish and a second one from Spanish into English) or a college term paper or a substantive writing sample (minimum 1,000 words) in Spanish and a second paper written in English.
- **Interview -** An oral interview with the Graduate Program Director
- **Three Letters of Reference -** For those interested in the LLC concentration, at least two of the letters must be from professors. For those interested in the TIS concentration, at least one of the letters must come from a professor, and letters not written by a professor must be from professionals working in the field of Spanish, translation and interpreting, or a closely related area (e.g., Latin American Studies, International Studies, International Business). Letters not written by professors should not come from a friend or family member, but from a work supervisor or somebody in a similar professional capacity.

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Prerequisite Requirements
LLC concentration applicants who do not have advanced-level undergraduate coursework in Spanish language and the literature and culture of Spain and Latin America will be required to take a minimum of two courses in these areas as part of their preparation for enrollment in the M.A. program. Such coursework may be taken as a post-baccalaureate graduate student (PBG), and up to 6 credit hours of such coursework with a grade of B or higher may be transferred forward to the M.A. program upon admission to the program. Applicants should consult with

the Program Director for counseling.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Master of Arts in Spanish requires 30 graduate credit hours. For any course to count toward the M.A. in Spanish, it must have been taken within seven years from the date of enrollment in the program. No more than 6 credit hours evaluated with a grade of C may be counted toward the minimum hours required for the master's degree. Up to 6 credit hours of appropriate graduate coursework may be accepted for transfer from a college or university accredited by an accepted accrediting body. Additional non-residence credit for graduate study abroad may be possible via departmental pre-approval.

Concentrations

Language, Literature, and Culture (LLC) Concentration (30 credit hours)

The LLC concentration allows for an in-depth development of Spanish language skills and is especially recommended for teachers of Spanish. It also provides excellent preparation for individuals who may wish to pursue the Ph.D. in Spanish, for whom courses in literature and linguistics are especially recommended. Students may take either: (1) 30 credit hours of elective courses or (2) 24 credit hours of elective courses plus a master's thesis (6 credit hours).

Elective Courses (24-30 credit hours)

Select from the following:

SPAN 5011 - Studies in Spanish American Prose Fiction (3)
SPAN 5050 - Selected Topics in Spanish (1 to 3)
SPAN 5121 - Advanced Business Spanish II (3)
SPAN 5122 - Studies in Advanced Business Spanish (3)
SPAN 5201 - Nineteenth Century Spanish Literature (3)
SPAN 5202 - Twentieth Century Spanish Literature (3)
SPAN 5205 - Novel of the Golden Age (3)
SPAN 5206 - Theater of the Golden Age (3)
SPAN 5210 - Studies in Spanish American Poetry (3)
SPAN 5212 - Studies in Spanish American Theater (3)
SPAN 5213 - Cervantes (3)
SPAN 5410 - Professional Internship in Spanish (1-6) *(up to 3 credit hours may be applied toward the degree)*
SPAN 6003 - Studies in Hispanic Culture and Civilization (3)
SPAN 6005 - Advanced Studies in Spanish Literature (3)
SPAN 6007 - Advanced Studies in Spanish American Literature (3)
SPAN 6201 - Hispanic Language and Culture through Media (3)
SPAN 6901 - Advanced Project (1 to 3)

Note: With the approval of the department, students may take 3 elective credit hours in related areas as part of the 24-30 credit hours. To do so, students must submit a written request to the Graduate Program Director explaining how these hours of elective courses will enrich their program.

Thesis (0-6 credit hours)

The master's thesis may include Spanish and Spanish American literature; Spanish and Spanish American civilization and culture (including literature and film studies); Spanish linguistics, methodology, applied language (Spanish for business and international trade); and other special topics in Spanish.

SPAN 6902 - Thesis (1-6)

Translation and Interpreting Studies (TIS) Concentration

The TIS concentration serves individuals interested in a career in professional translation or in enhancing their career or work opportunities as specialists in the language and culture industries. It also provides preparation for those who may wish to pursue a Ph.D. in fields such as Spanish, linguistics, translating and translation studies, intercultural communication, or international studies. Students may take either: (1) 30 credit hours of elective courses or (2) 24 credit hours of elective courses plus a master's thesis (6 credit hours).

Spanish Elective Courses (6 credit hours)

Select two from:

SPAN 5xxx - Spanish Elective (3)
SPAN 6xxx - Spanish Elective (3) *(excluding SPAN 6902)*

Translation and Interpreting Studies Elective Courses (18-24 credit hours)

Select from the following:

TRAN 5050 - Topics in Translation Practica (3)
TRAN 6000 - Special Topics in Translation Studies (3)
TRAN 6472 - Workshop on Non-Literary Topics I (Business, Legal, Governmental) (3)
TRAN 6474 - Workshop on Non-Literary Topics II (Medical and Technical) (3)
TRAN 6476 - Workshop on Literary and Cultural Topics (3)
TRAN 6480 - Translation Internship (1-6) *(up to 3 credit hours may be applied toward the degree)*
TRAN 6481 - Translation Cooperative Education (1 to 3)
TRAN 6601 - History, Theory, and Method of Translation (3)
TRAN 6602 - Linguistics for Translators (3)
TRAN 6603 - Computer-Assisted Translating (3)
TRAN 6604 - Translation Project Management (3)
TRAN 6901 - Advanced Project in English↔Spanish

Translating (1 to 3)
INTE 5050 - Topics and Practicum in Interpreting (3)
INTE 6050 - Topics in Interpreting Studies (3)
INTE 6172 - Spanish-English Legal Interpreting (3)
INTE 6174 - Spanish-English Medical Interpreting (3)
INTE 6176 - Spanish-English Community Interpreting (3)
INTE 6601 - History, Theory, and Method of Interpreting (3)
LACS 5050 - Topics in Foreign Language (3)

Note: With the approval of the department, students may take 3 elective credit hours in related areas as part of the 24-30 credit hours. To do so, students must submit a written request to the Graduate Program Director explaining how these hours of elective courses will enrich their program.

Thesis (0-6 credit hours)
TRAN 6902 - Thesis (1 to 6)

The master's thesis may include the history, theory, and method of translation; linguistics for translators; translation project management and technologies; and the analysis and translation of different types of texts and discourse: business, technical, medical, legal, scholarly, and literary.

Degree Total = 30 Credit Hours

Advising
Graduate students are advised by the Graduate Program Director and by designated graduate faculty members in good standing.

Comprehensive Examination
After Admission to Candidacy, students must successfully complete a comprehensive examination. Students must be enrolled during the semester in which they take the comprehensive examination, which is usually taken during their final semester of enrollment in the program. The exams are scheduled twice a year: usually in mid to late November of each Fall semester and in mid to late April of each Spring semester.

Application for Degree
Students should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Assistantships
A limited number of graduate assistantships are available on a competitive basis each year. Applications must be received no later than April 15 for assistantships beginning the following academic year. Further information is available in the Department of Languages and Culture Studies.

Cooperative Education
The Department offers TRAN 6481 (Translation Cooperative Education) to provide on-site work in translating texts or interpreting, English↔Spanish, with site, workload, and remuneration to be determined in consultation with employer and one faculty co-op advisor. Provides practical and professional training experience under conditions that the University cannot duplicate.

Internships
The Department approves a limited number of internships (SPAN 5410 and TRAN 6480) which provide program-related experience for graduate students who seek to develop their Spanish skills in a professional setting. Further information is available in the Department of Languages and Culture Studies.

Licensure
Students seeking licensure in Spanish should obtain information on requirements from the Office of Teacher Education Advising and Licensure (TEAL) in the College of Education.

Tuition Waivers
A limited number of in-state as well as out-of-state tuition waivers may be available for new graduate assistants and/or outstanding applicants.

Graduate Certificate in Languages and Culture Studies: Business Languages

The Department of Languages and Culture Studies offers a Graduate Certificate in Languages and Culture Studies: Business Language with concentrations in the following languages: German and Spanish. It is designed for Early Entry, post-baccalaureate, graduate, and post-graduate students. Students typically complete the required 12 graduate credit hours in 2-3 semesters, and may begin the program in either the Fall or Spring semester.

Students in the certificate program pursue advanced study of language, culture, and intercultural communication in business German or Spanish, which involves intensive development of speaking, listening comprehension, reading, writing, translation, and interpreting skills focused on topics such as business communications, economics, management, banking, real estate, office systems, marketing (logistics and advertising), finance, import-export, and e-commerce. Graduate level coursework may also include 6 credit hours of special topics courses in business language studies, graduate courses in German or Spanish, related coursework from another graduate program such as Latin American Studies or International

Business, and up to 3 credit hours of professional internship credit in an appropriate intercultural communication or target-language business setting.

Admission Requirements

Students must apply for admission to the Graduate School and must have a minimum undergraduate GPA of 2.75. Applicants will generally have a baccalaureate degree in one of the certificate languages: German or Spanish, or in a closely related area that requires sufficient upper-division coursework in that language (e.g., for Spanish: Latin American Studies, International Studies, International Business), or an Undergraduate Certificate or Minor in German or Spanish.

Applicants are required to submit:

- A well-developed essay in English that addresses the applicant's motivation for enrolling in the Graduate Certificate
- Two letters of reference (typically from professors, intercultural communications specialists in language or business, and/or employers, preferably in a business field)
- Official scores on the Test of English as a Foreign Language (TOEFL) (International Students only)

Notes: Applicants may be required to have an interview with the Graduate Director. Students interested in adding this Graduate Certificate to the M.A. in Spanish must apply separately for the certificate program; one application does not cover both programs. Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the Undergraduate Catalog for details and requirements. Also see the Degree Requirements and Academic Policies section of the Graduate Catalog for more information about Early Entry Programs.

Certificate Requirements

Select one of the following concentrations:

Concentration in German

Core Courses (6 credit hours)

GERM 5120 - Advanced Business German I (3)
GERM 5121 - Advanced Business German II (3)

Elective Courses (6 credit hours)

Select two of the following:

GERM 5050 - Special Topics in German (1 to 3)
GERM 5410 - Professional Internship in German (1 to 6)
GERM 5800 - Directed Individual Study (1 to 3)
INTE 5050 - Topics and Practicum in Interpreting (3)
INTE 6050 - Topics in Interpreting Studies (3)
INTE 6601 - History, Theory, and Method of Interpreting (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 5412 - Practicum in Translating I - German (3)
TRAN 5413 - Practicum in Translating II - German (3)
TRAN 5414 - Practicum in Translating III - German (3)
TRAN 6000 - Special Topics in Translation Studies (3)
TRAN 6601 - History, Theory, and Method of Translation (3)
TRAN 6602 - Linguistics for Translators (3)
TRAN 6603 - Computer-Assisted Translating (3)
TRAN 6604 - Translation Project Management (3)
ECON 5172 - Economics of International Finance (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6194 - Global Strategic Management (3)
MBAD 6270 - Marketing Management (3)
MSMG 6120 - Management and Organizational Behavior (3)
MSMG 6130 - Economics for Managers (3)
MSMG 6160 - Marketing from a Management Perspective (3)
MSMG 6190 - Managerial Ethics and Leadership (3)

Concentration in Spanish

Core Courses (6 credit hours)

SPAN 5120 - Advanced Business Spanish I (3)
SPAN 5121 - Advanced Business Spanish II (3)

Elective Courses (6 credit hours)

Select two of the following:

SPAN 5050 - Selected Topics in Spanish (1 to 3)
SPAN 5122 - Studies in Advanced Business Spanish (3)
SPAN 5410 - Professional Internship in Spanish (1 to 6)
SPAN 5800 - Directed Individual Study (1 to 3)
SPAN 6001 - Advanced Studies in Spanish Language (3)
SPAN 6003 - Studies in Hispanic Culture and Civilization (3)
SPAN 6201 - Hispanic Language and Culture through Media (3)
SPAN 6901 - Advanced Project (1 to 3)
INTE 5050 - Topics and Practicum in Interpreting (3)
INTE 6050 - Topics in Interpreting Studies (3)
INTE 6176 - Spanish-English Community Interpreting (3)
INTE 6601 - History, Theory, and Method of Interpreting (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 6000 - Special Topics in Translation Studies (3)
TRAN 6472 - Workshop on Non-Literary Topics I (Business, Legal, Governmental) (3)
TRAN 6601 - History, Theory, and Method of Translation (3)
TRAN 6602 - Linguistics for Translators (3)
TRAN 6603 - Computer-Assisted Translating (3)
TRAN 6604 - Translation Project Management (3)
ECON 5172 - Economics of International Finance (3)
LTAM 5000 - Graduate Topics in Latin American Studies (3)
LTAM 5600 - Seminar in Latin American Studies (3)

LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3)
LTAM 6100 - Seminar in Latin American Politics (3)
LTAM 6252 - Seminar in Modern Latin American History (3)
LTAM 6300 - Seminar in Latin American Thought (3)
MBAD 6161 - Human Behavior in Organizations (3)
MBAD 6194 - Global Strategic Management (3)
MBAD 6270 - Marketing Management (3)
MSMG 6120 - Management and Organizational Behavior (3)
MSMG 6130 - Economics for Managers (3)
MSMG 6160 - Marketing from a Management Perspective (3)
MSMG 6190 - Managerial Ethics and Leadership (3)

Certificate Total = 12 Credit Hours

Grade Requirements
The Graduate Certificate in Languages and Culture Studies: Business Language is earned by completion of 12 credit hours of graduate coursework (4 courses) with a grade of B or above in each course.

Transfer Credit
Generally, only graduate courses taken at UNC Charlotte count toward the Graduate Certificate. However, 3 credit hours of coursework may be considered for possible transfer into the certificate program if approved by the Department of Languages and Culture Studies. 9 of the 12 credit hours for the Graduate Certificate must be taken in residency.

Graduate Certificate in Languages and Culture Studies: Translating

The Department of Languages and Culture Studies offers a Graduate Certificate in Languages and Culture Studies: Translating with options in the following language pairs: English-French, English-German, English-Japanese, English-Russian, and English-Spanish. It is designed for Early Entry, post-baccalaureate, graduate, and post-graduate students. Students typically complete the required 12 graduate credit hours in 2-3 semesters, and may begin the program in either the Fall or Spring semester.

Students in the certificate program study the history, theory, methodology, and profession of translation; work intensively in the analysis and translation of different types of discourse, including non-literary and literary texts; become familiar with computer-assisted translation; and develop advanced post-editing skills. Graduate level coursework may also include special topics courses in translation and up to 3 credit hours of professional internship credit in translating. Translating is done in both directions of a given language pair:

- English ↔ French
- English ↔ German
- English ↔ Japanese
- English ↔ Russian
- English ↔ Spanish

Admission Requirements
Students must apply for admission to the Graduate School and must have a minimum undergraduate GPA of 2.75. Applicants will generally have a baccalaureate degree in one of the certificate languages: French, German, Japanese, Russian, or Spanish, or in a closely related area that requires sufficient upper-division coursework in that language (e.g., for Spanish, Latin American Studies, International Studies, International Business), or an undergraduate degree, certificate, or minor in translation.

Applicants are required to submit:
- A well-developed essay in English that addresses the applicant's motivation for enrolling in the Graduate Certificate
- Three letters of reference (from professors, specialists in translation, and/or employers, preferably in the field)
- An oral interview with the Graduate Program Director
- A sample of translations into or from the language pair selected (with original text to accompany each translation submitted)
- Official scores on the Test of English as a Foreign Language (TOEFL) *(International Students only)*

Notes: Students interested in adding this Graduate Certificate to the M.A. in Spanish must apply separately for the certificate program. One application does not cover both programs. Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements
Core Courses (6 credit hours)
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 6000 - Special Topics in Translation Studies (3)

TRAN 6601 - History, Theory, and Method of Translation (3)
TRAN 6602 - Linguistics for Translators (3)
TRAN 6603 - Translating and the Computer (3)
TRAN 6604 - Translation Project Management (3)

Language-Specific Translation Courses (6 credit hours)
Select courses from the language being studied. With permission of the department, students may substitute one of the Core Courses not previously taken or TRAN 6480 for three credit hours.

French
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 5402 - Practicum in Translating I – French (3)
TRAN 5403 - Practicum in Translating II – French (3)
TRAN 5404 - Practicum in Translating III – French (3)

German
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 5412 - Practicum in Translating I – German (3)
TRAN 5413 - Practicum in Translating II – German (3)
TRAN 5414 - Practicum in Translating III – German (3)

Japanese
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 5422 - Practicum in Translating I – Japanese (3)
TRAN 5423 - Practicum in Translating II – Japanese (3)
TRAN 5424 - Practicum in Translating III – Japanese (3)

Russian
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 5432 - Practicum in Translating I – Russian (3)
TRAN 5433 - Practicum in Translating II – Russian (3)
TRAN 5434 - Practicum in Translating III – Russian (3)

Spanish
Select two of the following:
LACS 5050 - Topics in Foreign Language (3)
TRAN 5050 - Topics in Translation Practica (3)
TRAN 6472 - Workshop on Non-Literary Topics I (Business, Legal, Governmental) (3)
TRAN 6474 - Workshop on Non-Literary Topics II (Medical and Technical) (3)
TRAN 6476 - Workshop on Literary and Cultural Topics (3)

Certificate Total = 12 Credit Hours

Transfer Credit
Generally, only graduate courses taken at UNC Charlotte count toward the Graduate Certificate. However, 3 credit hours of coursework may be considered for possible transfer into the certificate program if approved by the Department of Languages and Culture Studies. 9 of the 12 credit hours for the Graduate Certificate must be taken in residency.

Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies, Spanish-English

The Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies focuses on the following language pair: Spanish-English. It is designed for Early Entry, post-baccalaureate, graduate, and post-graduate students. Students typically complete the required 12 graduate credit hours in 2-3 semesters, and may begin the program in either the Fall or Spring semester.

Students in the certificate program study the history, theory, methodology, and profession of translation and interpreting; work intensively in the analysis of different types of written and oral discourse; become familiar with computer-assisted translation, sight translation, simultaneous and consecutive interpreting; and develop advanced post-editing skills. Graduate level coursework may also include special topics courses in translation and interpreting and up to 3 credit hours of professional internship credit in translating and interpreting. Translating and interpreting is done in both directions of the language pair: Spanish ↔ English.

Admission Requirements
Students must apply for admission to the Graduate School and must have a minimum undergraduate GPA of 2.75. Applicants will generally have a baccalaureate degree in Spanish, or in a closely related area that requires sufficient upper-division coursework in that language (e.g., for Spanish, Latin American Studies, International Studies, International Business), or an undergraduate degree, certificate, or minor in translation.

Applicants are required to submit:

- A well-developed essay in English that addresses the applicant's motivation for enrolling in the Graduate Certificate
- Three letters of reference (from professors, specialists in translation, and/or employers, preferably in the field)

- An oral interview with the Graduate Program Director
- A sample of translations into or from the language pair selected (with original text to accompany each translation submitted)
- Official scores on the Test of English as a Foreign Language (TOEFL) (International Students only)

Note: Students interested in adding this Graduate Certificate to the M.A. in Spanish must apply separately for the certificate program. One application does not cover both programs. Standardized test scores (e.g., GRE, MAT) are not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Certificate Requirements

Core Courses (6 credit hours)

Select two of the following:

INTE 6050 - Topics in Interpreting Studies (3)
INTE 6601 - History, Theory, and Method of Interpreting (3)
TRAN 6000 - Special Topics in Translation Studies (3)
TRAN 6601 - History, Theory, and Method of Translation (3)
TRAN 6602 - Linguistics for Translators (3)
TRAN 6603 - Computer-Assisted Translating (3)
TRAN 6604 - Translation Project Management (3)

Spanish-Specific Translation or Interpreting Courses (6 credit hours)

Select two of the following:

INTE 6172 - Spanish-English Legal Interpreting (3)
INTE 6174 - Spanish-English Medical Interpreting (3)
INTE 6176 - Spanish-English Community Interpreting (3)
TRAN 6472 - Workshop on Non-Literary Topics I (Business, Legal, Governmental) (3)
TRAN 6474 - Workshop on Non-Literary Topics II (Medical and Technical) (3)
TRAN 6476 - Workshop on Literary and Cultural Topics (3)

Note: The group of four courses selected must include a minimum of one INTE course and one TRAN course.

Grade Requirements

A grade of A or B is required for each course.

Transfer Credit

Generally, only graduate courses taken at UNC Charlotte count toward the graduate certificate. However, 3 credit hours of coursework may be considered for possible transfer into the certificate program if approved by the Department of Languages and Culture Studies. 9 of the 12 credit hours for the Graduate Certificate must be taken in residency.

Certificate Total = 12 Credit Hours

LATIN AMERICAN STUDIES

- M.A. in Latin American Studies

Graduate Program
latinamericanstudies.charlotte.edu

M.A. in Latin American Studies

The program in Latin American Studies leading to the Master of Arts degree provides students with the skills and knowledge to understand and analyze the societies of Latin America and the Caribbean—a region of key importance in the age of globalization and mass migration. The program will provide an excellent foundation for advanced graduate study in the humanities, social sciences, and law. It is also designed to prepare the growing number of students who seek careers in the foreign service and other government agencies as well as those who will seek employment in non-governmental organizations with an international or cross-cultural orientation or in international business. Finally, it will also serve as an important qualification for individuals in education and the social services who work with the burgeoning Hispanic population of North Carolina.

The M.A. program in Latin American Studies has the following educational objectives:

- To study the culture, geography, history, politics, and society of Latin America and the Spanish-speaking Caribbean
- To provide an understanding of the socio-cultural background of the Latino population in the United States
- To understand economic development and underdevelopment from a comparative perspective
- To undertake interdisciplinary research in the humanities and social sciences using a variety of methodologies
- To instill writing and critical thinking skills by teaching rigorous scholarly inquiry and research methods at a level appropriate for graduate education
- To develop language competencies in Spanish and/or Portuguese

Admission Requirements
In addition to the general requirements for admission to the Graduate School, an undergraduate degree, preferably in Latin American Studies or in a related field such as NAnthropology, Architecture, Art, Geography, History, International Business, International Studies, Political Science, Portuguese, Sociology, or Spanish, with a GPA of at least 3.0 is required. However, the admissions committee will consider applicants with an average lower than this minimum if the other elements of the application are strong.

Spanish proficiency at the advanced level as demonstrated by undergraduate coursework, an oral interview, a standardized test, and/or life experience is also required. Knowledge of Portuguese is desirable but not required.

The following documents must be submitted for admission:
- UNC Charlotte Graduate School online application form
- Official academic transcripts
- Statement of purpose
- Evidence of proficiency in Spanish
- Three letters of recommendation on the UNC Charlotte recommendation form
- International students only: evidence of proficiency in English as well as the following UNC Charlotte forms: immigration status, statement of financial responsibility, and estimated expenses

Note: GRE scores are optional.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program
Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements
The Master of Arts degree in Latin American Studies requires completion of at least 30 credit hours in approved graduate courses. These courses must include at least 18 credit hours which are only open to graduate students. No more than 12 credit hours may be taken for credit in the degree program at the 5000 level. A maximum of 6 hours of graduate transfer credit will be accepted.

Most students complete the program in two to three years. No course listed on a master's student's candidacy form be older than six years at the time of graduation. Courses that exceed this time limit must be revalidated or retaken, whichever the graduate program decides necessary, if they are to count in a degree program.

At the end of the program, students will display Spanish proficiency at the advanced level in speaking, reading, and writing.

Tracks

Students select one of two tracks within the degree program: (1) a Thesis track or (2) an Examination track. The Thesis track prepares students for graduate work at the doctoral level in Latin American Studies or one of its constituent disciplines. The Examination track prepares students for employment in the private and public sectors.

Thesis Track (30 credit hours)

Interdisciplinary Core Courses (12 credit hours)

LTAM 5600 - Seminar in Latin American Studies (3) *(two sections)*
LTAM 6910 - Thesis Tutorial (3)
LTAM 6920 - Master's Thesis (3)* -

**As part of the Master's Thesis course, students prepare and defend a thesis before a committee composed of three faculty members from at least two different disciplines. A satisfactory grade (A or B) on the thesis is required for graduation.*

Multidisciplinary Elective Courses (18 credit hours)

Social Sciences Courses (6 credit hours)
Select two of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(science-focused topic)*
LTAM 5116 - Culture and Conflict in the Amazon (3)
LTAM 5120 - Advanced Business Spanish I (3)
LTAM 5121 - Advanced Business Spanish II (3)
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(science-focused topic)*
LTAM 6100 - Seminar in Latin American Politics (3)
LTAM 6800 - Directed Readings (3) *(science-focused topic)*
LTAM 6801 - Directed Research (3) *(science-focused topic)*

History Courses (6 credit hours)
Select two of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(history-focused topic)*
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(history-focused topic)*
LTAM 6250 - Comparative Slavery and Race Relations (3)
LTAM 6251 - Seminar in Colonial Latin American History (3)
LTAM 6252 - Seminar in Modern Latin American History (3)
LTAM 6800 - Directed Readings (3) *(history-focused topic)*
LTAM 6801 - Directed Research (3) *(history-focused topic)*

Humanities Courses (6 credit hours)
LTAM 6300 - Seminar in Latin American Thought (3)

Plus select one of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(humanities-focused topic)*
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(humanities-focused topic)*
LTAM 5310 - Studies in Spanish American Poetry (3)
LTAM 5311 - Studies in Spanish American Prose Fiction (3)
LTAM 5312 - Studies in Spanish American Theater (3)
LTAM 6300 - Seminar in Latin American Thought (3)
LTAM 6307 - Advanced Studies in Spanish American Literature (3)
LTAM 6350 - Histories of Latin American Architecture (3)
LTAM 6800 - Directed Readings (3) *(humanities-focused topic)*
LTAM 6801 - Directed Research (3) *(humanities-focused topic)*

Note: - Listed above are acceptable elective courses; however, they are not limited to those listed. - Up to two of the elective courses may be independent studies (LTAM 6800 and/or LTAM 6801).

Examination Track (30 credit hours)

Interdisciplinary Core Courses (9 credit hours)

LTAM 5600 - Seminar in Latin American Studies (3) (two sections)
OR
LTAM 5600 Seminar in Latin American Studies (3)
and LTAM 6400 - Internship (3)

LTAM 6950 - Comprehensive Examination (3)*

**Based on an interdisciplinary reading list of at least 40 titles, students will take a written and oral comprehensive examination before a committee composed of three faculty members from at least two different disciplines. A satisfactory grade (A or B) on the written examination is required to proceed to the oral examination; in case of an unsatisfactory grade, the written examination may be retaken once. Similarly, a satisfactory grade of A or B on the oral examination is required for graduation, and the student may retake the oral examination once in case of an unsatisfactory grade.*

Multidisciplinary Elective Courses (18 credit hours)

Social Sciences Courses (6 credit hours)
Select two of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(science-focused topic)*

LTAM 5116 - Culture and Conflict in the Amazon (3)
LTAM 5120 - Advanced Business Spanish I (3)
LTAM 5121 - Advanced Business Spanish II (3)
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(science-focused topic)*
LTAM 6100 - Seminar in Latin American Politics (3)
LTAM 6800 - Directed Readings (3) *(science-focused topic)*
LTAM 6801 - Directed Research (3) *(science-focused topic)*

History Courses (6 credit hours)
Select two of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(history-focused topic)*
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(history-focused topic)*
LTAM 6250 - Comparative Slavery and Race Relations (3)
LTAM 6251 - Seminar in Colonial Latin American History (3)
LTAM 6252 - Seminar in Modern Latin American History (3)
LTAM 6800 - Directed Readings (3) *(history-focused topic)*
LTAM 6801 - Directed Research (3) *(history-focused topic)*

Humanities Courses (6 credit hours)
LTAM 6300 - Seminar in Latin American Thought (3)

Plus select one of the following:
LTAM 5000 - Graduate Topics in Latin American Studies (3) *(humanities-focused topic)*
LTAM 6000 - Advanced Graduate Topics in Latin American Studies (3) *(humanities-focused topic)*
LTAM 5310 - Studies in Spanish American Poetry (3)
LTAM 5311 - Studies in Spanish American Prose Fiction (3)
LTAM 5312 - Studies in Spanish American Theater (3)
LTAM 6300 - Seminar in Latin American Thought (3)
LTAM 6307 - Advanced Studies in Spanish American Literature (3)
LTAM 6350 - Histories of Latin American Architecture (3)
LTAM 6800 - Directed Readings (3) *(humanities-focused topic)*
LTAM 6801 - Directed Research (3) *(humanities-focused topic)*

Elective Course (3 credit hours)
Select one additional course from any of the above categories.

Note: Listed above are acceptable elective courses; however, they are not limited to those listed. Up to two of the elective courses may be independent studies (LTAM 6800 and/or LTAM 6801).

Degree Total = 30 Credit Hours

Admission to Candidacy

Students are admitted to candidacy either by defending a thesis or taking a comprehensive examination.

Grade Requirements

Students must maintain a 3.0 GPA in all LTAM graduate courses to remain in and graduate from the program. As per the academic regulations of the UNC Charlotte Graduate School, one U or more than two grades of C in graduate coursework will lead to suspension in enrollment.

LIBERAL STUDIES

- M.A. in Liberal Studies

Graduate Program
mals.charlotte.edu

M.A. in Liberal Studies

The Master of Arts in Liberal Studies degree program (MALS) is primarily designed for adults seeking to enhance their general education in the liberal arts at the graduate level. It provides a flexible, multidisciplinary framework to accommodate the varied undergraduate backgrounds and personal interests that students bring to the program. The curriculum draws upon the full range of the liberal arts studies, including humanities, social sciences, and natural sciences courses. The emphasis is on an interdisciplinary, liberal arts education rather than on specialized, single disciplinary study or professional training.

For recent recipients of the baccalaureate degree, the Liberal Studies program may provide the insight needed to make an informed career choice. For returning students, graduate interdisciplinary, liberal studies may enhance opportunities in a career already launched or renew ties with university life . For persons with significant work experience, the program offers a chance to integrate the life of the mind with that of the workplace. Just as students come to the Liberal Studies program from a variety of fields, so they pursue a variety of careers after graduation. The most widely represented are in business, education, government, law, and social services.

The degree can be completed in two years as a full-time student and, possibly, three years as a part-time student. While some courses are offered at night and online, many others are offered during the weekday.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Liberal Studies:

1) A GPA of at least 3.0 on academic work beyond high school and 3.0 for courses prerequisite to the area of proposed graduate study
2) A two-page essay describing the applicant's objectives in undertaking graduate work in Liberal Studies. Students are encouraged to articulate an area of study that they would like to study during their time in the program.
3) A resume of employment history or volunteer experience (for applicants who have been out of school for at least five years or whose baccalaureate degree was delayed)

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Degree Requirements
The master's program in Liberal Studies requires a minimum of 30 credit hours of graduate work, including at least 15 credit hours in courses open only to graduate students.

Students must take three core MALS courses for a total of 9 credit hours. The remaining seven courses (21 credit hours) may be taken in any department(s), with approval. This flexibility allows students to customize the MALS curriculum to their individual needs and interests, working in concert with their professors and the MALS Graduate Program Director.

Students may enroll in the MALS program after completing or in the process of obtaining a graduate certificate. Up to 12 credit hours from the certificate will be counted for the MALS degree. The final 18 credit hours are composed of the 9 credit hours of MALS core courses and 9 credit hours from the interdisciplinary, liberal arts interest of the students. This ensures both an interdisciplinary, liberal arts experience for the students and the ability to finish the MALS degree in a timely manner.

Core Courses (9 credit hours)
MALS 6101 - The Liberal Arts Tradition (3)
MALS 6102 - Writing and Thinking Across the Disciplines (3)
MALS 6600 - Liberal Studies Capstone Seminar (3)

Elective Courses (21 credit hours)
Select seven additional courses from any department(s), with the instructor's permission and approval. The courses must be chosen in consultation with the MALS Graduate Program Director. Students are strongly encouraged to take courses across departments and disciplines in ways that expand their knowledge and analysis of a specific topic of interest.

No more than 6 credit hours of directed reading/research or independent study may be applied to the degree. Approval for MALS 6890 (Directed Research) comes from the Graduate Director and the disciplinary instructor. A form for MALS 6890 is available in the Director's office and must be completed and the directed reading/research or study approved in advance of registration.

Degree Total = 30 Credit Hours

Grade Requirements

Students must have a cumulative GPA of 3.0 in courses in their degree plan of study in order to graduate. Please consult the Graduate School's grading policies under "Degree Requirements and Academic Policies."

MATHEMATICS AND STATISTICS

- Ph.D. in Applied Mathematics
- Ph.D. in Curriculum and Instruction: Mathematics Education Concentration
  (see College of Education section)
- M.S. in Mathematics
  - General Mathematics
  - Applied Mathematics
  - Mathematics Education
  - Actuarial Statistics
  - Applied Statistics
- M.S. in Mathematical Finance
  (see Belk College of Business section)

Department of Mathematics and Statistics

math.charlotte.edu

Ph.D. in Applied Mathematics

The Ph.D. degree program in Applied Mathematics is designed to enable its students to master a significant body of mathematics, including a specialty in applied mathematics; to relate this knowledge to a coherent area of science or engineering; and to carry on fundamental research in applied mathematics at a nationally competitive level. Recipients of this degree will, according to their abilities and choice of sub-specialty, be able to work effectively in a research and development environment involving mathematical or statistical analysis and modeling in business, government or industry; to teach mathematics at the college or university level; or to carry on fundamental research in their area of specialty.

Admission Requirements

In addition to the requirements of the Graduate School for admission to doctoral study, applicants must have completed at least 27 credit hours of courses in the mathematical sciences at the undergraduate level, as approved by the department Graduate Committee, with grades of a C or above. Admission requires that the candidate be able to take MATH 8143 or be able to take MATH 5143 and have other factors in their record that indicate strong potential to complete the program. For prospective students who have completed work in mathematics beyond the bachelor's degree, performance on that work will be considered in admission decisions.

Applicants are required to take the GRE General Test or the GMAT and have their test scores sent directly from

the testing agency to the Office of Graduate Admissions at UNC Charlotte. However, there are two exceptions:

- A student who has already earned a Ph.D., M.D., or J.D. from a U.S. institution will not be required to take a standardized test.
- A student who has already earned a Master's degree from a U.S. institution will not be required to take a standardized test IF the student can demonstrate that they have completed the test in the past. In such cases, the program will accept the official student's copy of the official test scores (note that a photocopy is not acceptable) or an official university transcript on which the scores are printed or a letter on official university letterhead attesting to the score.

Students are admitted to the program by the Graduate School, based on the recommendation of the department Graduate Committee or its designate, the Graduate Program Director. Recommendations are based on the Committee's judgment of the candidate's ability to complete the program, as supported by the application materials. The department may waive certain requirements if it judges the candidate to be nonetheless capable of completing the program. If there are more candidates than can be accommodated, candidates are admitted in order of perceived mathematical ability, promise of success, and suitability to the program.

Degree Requirements

Students must complete an approved program of study of at least 54 credit hours, including the following:

Required Courses

MATH 8143 - Real Analysis I (3)
MATH 8144 - Real Analysis II (3)
MATH 8120 - Probability Theory I (3) *(if the student has a statistics focus)*
MATH 8994 - Doctoral Research and Reading (0 to 9) *(at least 18 research credit hours)*

Minor Courses

The minor is interdisciplinary and may be satisfied by 9 credit hours of graduate coursework outside the Department of Mathematics and Statistics, by 6 credit hours of MATH 8892 or STAT 8892 for a directed project in an area of application, or by a combination of external coursework and directed project in an area of application totaling 9 credit hours. It is expected that interdisciplinary minor courses shall in general be in STEM disciplines, but if there are applications in the student's dissertation work towards the social sciences, courses in those fields are allowed too. Examples of interdisciplinary minor courses allowed for several fields include:

Physics

PHYS 5222 - Classical Mechanics II (3)
PHYS 5232 - Electromagnetic Theory II (3)
PHYS 5242 - Modern Physics II (3)
PHYS 5271 - Waves and Optics (3)
PHYS 6101 - Biophysics (3)
PHYS 6121 - Classical Dynamics (3)
PHYS 6131 - Classical Electromagnetism I (3)
PHYS 6132 - Classical Electromagnetism II (3)
PHYS 6141 - Quantum Theory I (3)
PHYS 6142 - Quantum Theory II (3)
PHYS 6201 - Fourier Optics (3)
PHYS 6203 - Methods of Molecular Modeling and Simulation in Physics (3)
PHYS 6210 - Theoretical Physics (3)
PHYS 6211 - Introduction to Modern Optics (3)
PHYS 6221 - Optical Communications I (3)
PHYS 6241 - Light Sources and Detectors (3)
PHYS 6251 - Statistical Physics (3)
PHYS 6261 - Nuclear Physics (3)
PHYS 6271 - Advanced Solid State Physics (3)

Optics

OPTI 8101 - Mathematical Methods of Optical Science and Engineering (3)
OPTI 8102 - Principles of Geometrical Optics (3)
OPTI 8104 - Electromagnetic Waves (3)
OPTI 8105 - Optical Properties of Materials (3)
OPTI 8211 - Introduction to Modern Optics (3)

Mechanical Engineering

MEGR 8102 - Introduction to Continua (3)
MEGR 8113 - Dynamics and Thermodynamics of Compressible Flow (3)
MEGR 8116 - Fundamentals of Heat Transfer and Fluid Flow (3)
MEGR 8125 - Vibrations of Continuous Systems (3)
MEGR 8141 - Theory of Elasticity I (3)
MEGR 8142 - Theory of Elasticity II (3)
MEGR 8143 - Inelastic Behavior of Materials (3)
MEGR 8164 - Diffraction/Spectroscopic Studies of Matter (3)

Computer Science

ITCS 8111 - Evolutionary Computation (3)
ITCS 8114 - Algorithms and Data Structures (3)
ITCS 8115 - Advanced Topics in Algorithms and Data Structures (3)
ITCS 8150 - Intelligent Systems (3)
ITCS 8153 - Neural Networks (3)
ITCS 8155 - Knowledge-Based Systems (3)
ITCS 8156 - Machine Learning (3)
ITCS 8165 - Coding and Information Theory (3)
ITCS 8170 - Logic for Artificial Intelligence (3)
ITCS 8171 - Logic Programming (3)
ITCS 8220 - Pattern Recognition (3)
ITCS 8226 - Bioinformatics (3)

Finance and Economics
Any FINN or ECON courses listed under the M.S. in Mathematical Finance program. - Examples include:

FINN 6203 - Financial Economic Theory (3)
FINN 6210 - Financial Elements of Derivatives (3)
FINN 6211 - Fixed Income Securities and Credit Risk (3)
ECON 6112 - Graduate Econometrics (3)
ECON 6113 - Cross-Section and Time-Series Econometrics (3)
ECON 6206 - Game Theory and Experiments (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)
ECON 6219 - Financial Econometrics (3)

Elective Courses

Select elective courses from the following approved list.
MATH 5128 - Applied Probability I (3)
MATH 5129 - Applied Probability II (3)
MATH 5143 - Analysis I (3)
MATH 5144 - Analysis II (3)
MATH 5161 - Number Theory (3)
MATH 5163 - Modern Algebra (3)
MATH 5164 - Abstract Linear Algebra (3)
MATH 5165 - Numerical Linear Algebra (3)
MATH 5171 - Numerical Solution of Ordinary Differential Equations (3)
MATH 5172 - The Finite Element Method (3)
MATH 5173 - Ordinary Differential Equations (3)
MATH 5174 - Partial Differential Equations (3)
MATH 5176 - Numerical Methods for Partial Differential Equations (3)
MATH 5181 - Introduction to Topology (3)
MATH 6201 - Statistical Techniques in Finance (3)
MATH 6202 - Derivatives II: Partial Differential Equations for Finance (3)
MATH 6203 - Stochastic Calculus for Finance I (3)
MATH 6204 - Numerical Methods for Financial Derivatives (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)
Any MATH 8000 course
STAT 5123 - Applied Statistics I (3)
STAT 5124 - Applied Statistics II (3)
STAT 5126 - Theory of Statistics I (3)
STAT 5127 - Theory of Statistics II (3)
STAT 6113 - Cross-Section and Time-Series Econometrics (3)
STAT 6115 - Statistical Learning with Big Data (3)
STAT 8027 - Topics in Statistics (3)
STAT 8122 - Advanced Statistics I (3)
STAT 8123 - Advanced Statistics II (3)
STAT 8124 - Sampling Theory (3)
STAT 8127 - Linear Statistical Models (3)
STAT 8133 - Multivariate Analysis (3)
STAT 8135 - Statistical Computation (3)
STAT 8137 - Survival Analysis (3)
STAT 8139 - Time Series Analysis (3)
STAT 8490 - Industrial Internship (0 to 6)
STAT 8891 - Independent Study in Statistics (1 to 3)

Degree Total = 54 Credit Hours

Assistantships

A number of graduate assistantships are available each year (with nationally-competitive stipends) for qualified applicants. A limited number of fellowship awards can be applied to supplement these stipends or provide stand-alone stipends for up to $25,000 for especially qualified students.

Dissertation

The student must complete and defend a dissertation based on a research program approved by the student's dissertation advisor which results in a high quality, original and substantial piece of research. The student must orally present and successfully defend the dissertation before the student's doctoral dissertation committee in a defense that is open to the public. A copy of the dissertation must be made available to the graduate faculty of the department at least two weeks prior to the public defense. The dissertation is graded on a pass/unsatisfactory basis by the dissertation committee and must be approved by the Department Graduate Program Director and the Dean of the Graduate School.

Dissertation Committee

Each student has a dissertation committee appointed by the department Graduate Committee in consultation with the student and approved by the Dean of the Graduate School. It includes the prospective dissertation advisor, as well as a department co-advisor, if the dissertation advisor is not a member of the Department of Mathematics and Statistics. The dissertation committee should be appointed as soon as is feasible, usually within a year after passing the Qualifying Examination. Once formed, it has the responsibility of constructing and approving the program of study which includes the minor. Prior to the appointment of the dissertation committee the student is advised by a graduate faculty member appointed by the department Graduate Committee.

Topic Approval Defense and Admission to Candidacy

After a student completes the qualifying examination and advanced coursework deemed necessary for the student's research as approved by the student's doctoral dissertation committee, the student, in consultation with the student's dissertation advisor, may propose a dissertation topic. The dissertation topic proposal must be articulated and defended at a meeting of the student's dissertation committee. A written dissertation proposal must be submitted to the dissertation committee at least two weeks prior to the scheduled defense. The student is

expected during the course of the topic defense to outline and demonstrate sufficient proficiency with the advanced knowledge and techniques to be used in the conduct of the research. The topic approval defense and the committee's deliberations in this regard are to be conducted according to the pertinent regulations of the Graduate School. A doctoral student advances to candidacy after the student's dissertation committee and the Dean of the Graduate School have approved the dissertation topic proposal.

Grade Requirements

Students are expected to achieve As or Bs in all courses included in the program of study and must have at least a 3.0 GPA to graduate. The dissertation is graded on a pass/unsatisfactory basis and, therefore, is not be included in the cumulative average. An accumulation of more than two marginal (C) grades will result in suspension of the student's enrollment in the program. If students make a grade of U on any course, enrollment will be suspended and students cannot take further graduate work without being readmitted to the program. Readmission to the program requires approval of the Dean of the Graduate School upon the recommendation of the department Graduate Committee.

Qualifying Examination

After being admitted to the Ph.D. program, students are expected to take the qualifying examination within three semesters. This time limit may be extended for up to two additional semesters in certain cases, depending on the background of the student and with program approval. The qualifying examination consists of two parts. The first part is a written examination based on Real Analysis I and II (MATH 8143 and MATH 8144) or Probability Theory I and Real Analysis I (MATH 8120 and MATH 8143), the latter intended for a student with a statistics focus. The second part is a written examination based on two other courses chosen by the student to be specifically related to the student's intended specialty and approved by the department Graduate Committee. Students may be allowed to retake a portion of the qualifying examination a second time if they do not pass that portion on the first attempt within the guidelines of the Graduate School regulations pertaining to the qualifying examination and as overseen by the department Graduate Committee. Students who do not complete the qualifying examination as per the regulations of the Graduate School are terminated from the Ph.D. program.

Residency Requirement

Full-time Ph.D. students must enroll for one continuous full-time year (i.e., two consecutive semesters of at least nine graduate credit hours in each semester) following admission to the program.

Time Limit for Degree Completion

Students must achieve admission to candidacy within six years after admission to the program and complete all requirements within six years after admission to candidacy for the Ph.D. degree. All requirements for the degree must be completed within nine years after first registration as a doctoral student.

Transfer Credit

Only courses with grades of A or B may be accepted for transfer credit. Transfer credit must be recommended by the department Graduate Committee and approved by the Dean of the Graduate School. The amount of transfer credit cannot exceed the limit set by the Graduate School.

Ph.D. in Curriculum and Instruction: Mathematics Education Concentration

The department also offers a Mathematics Education concentration to students enrolled in the Ph.D. program in Curriculum and Instruction in the College of Education. For details, please see the Curriculum and Instruction degree information located in the College of Education section of this *Catalog*.

M.S. in Mathematics

The Master of Science in Mathematics degree is organized into five concentrations.

The **Concentration in General Mathematics** is a robust but flexible program that allows a student to develop a broad background in Mathematics ranging over a variety of courses chosen from both pure and applied areas, or to tailor a program toward a particular focus that may not be as closely covered by the department's other degree concentrations (e.g., one that is interdisciplinary in nature).

The **Concentration in Applied Mathematics** develops analytical and computational skills focused toward applications of mathematics in the physical sciences as encountered in industry, government, and academia.

The **Concentration in Mathematics Education** is designed primarily for secondary school mathematics teachers interested in professional growth in mathematics teaching. Emphasis in this program is given to developing depth and breadth in mathematics teaching and learning, appropriate to the role of the secondary school teacher.

The **Concentration in Actuarial Statistics** provides advanced skills and knowledge to individuals seeking actuarial careers in insurance and financial institutions.

The **Concentration in Applied Statistics** provides theoretical understanding of, and training in, statistical analysis and methods applicable to particular areas of business, industry, government, and academia.

Admission Requirements

For general requirements for admission to The Graduate School, see The Graduate School section of this Catalog.

All applicants, regardless of which concentration is chosen, are required to take the GRE General Test or the GMAT and have their test scores sent directly from the testing agency to the Office of Graduate Admissions at UNC Charlotte. However, there are two exceptions:

1) A student who has already earned a Ph.D., M.D., or J.D. from a U.S. institution will not be required to take a standardized test.
2) A student who has already earned a Master's degree from a U.S. institution will not be required to take a standardized test if the student can demonstrate that they have completed the test in the past. In such cases, the program will accept the official student's copy of the official test scores (note that a photocopy is not acceptable) or an official university transcript on which the scores are printed or a letter on official university letterhead attesting to the score.

Each concentration within the M.S. in Mathematics has its own additional admission requirements listed below.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

All candidates, regardless of which concentration is chosen, are required to take two courses in mathematical or statistical analysis and a comprehensive exam. Students in all concentrations except for the Mathematics Education concentration may also choose a thesis option for 3-6 credit hours towards the required credit hour total.

Concentration in General Mathematics

The Master of Science in Mathematics with Concentration in General Mathematics program is designed both to provide advanced skills and knowledge for persons seeking positions in industry, government, or teaching at the community college level, and to provide professional development to persons currently in such positions. Qualified graduates are also prepared to enter directly into at least the second year of a Ph.D. program in mathematics, applied mathematics, or statistics, depending on the particular course of study.

Additional Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for the concentration in General Mathematics:

1) Applicants must present evidence of the satisfactory completion of at least 27 credit hours of mathematics approved by the department Graduate Committee.
2) It is recommended that the student have a basic knowledge of at least two of the areas of algebra, real analysis, and topology.

Concentration Requirements

The M.S. in Mathematics with Concentration in General Mathematics degree requires successful completion of at least 30 credit hours of graduate work approved by the department Graduate Committee, including: MATH 5143 and MATH 5144 or their equivalents; at least one course each from two of the groups I, II, III, V, and VI below; and at least 15 credit hours in 7000-level courses. No credit shall be given for 6000-level math courses other than mathematical finance courses in group V. With the approval of the department Graduate Committee, a 3 credit hour 6000-level course in another department of a theoretical nature or a 3 credit hour 6000-level mathematical finance course may be applied toward the 15 credit hours in the 7000-level courses. Candidates for the degree concentration must demonstrate, to the satisfaction of the department Graduate Committee, competence on general knowledge in at least three of six groups of courses listed below. This may be accomplished by (a) successful performance on a written or oral comprehensive examination or (b) successful completion of courses in these areas.

Group I - Applied Mathematics

MATH 5165 - Numerical Linear Algebra (3)
MATH 5171 - Numerical Solution of Ordinary Differential Equations (3)
MATH 5172 - The Finite Element Method (3)
MATH 5173 - Ordinary Differential Equations (3)
MATH 5174 - Partial Differential Equations (3)
MATH 5176 - Numerical Methods for Partial Differential Equations (3)

MATH 7172 - Partial Differential Equations (3)
MATH 7176 - Advanced Numerical Analysis (3)
MATH 7177 - Applied Optimal Control (3)
MATH 7178 - Computational Methods for Fluid Dynamics (3)
MATH 7180 - Advanced Numerical Methods in Scientific Computing (3)
MATH 7273 - Advanced Finite Element Analysis (3)

Group II - Probability-Statistics
STAT 5123 - Applied Statistics I (3)
STAT 5124 - Applied Statistics II (3)
STAT 5126 - Theory of Statistics I (3)
STAT 5127 - Theory of Statistics II (3)
STAT 7027 - Topics in Statistics (3)
STAT 7122 - Advanced Statistics I (3)
STAT 7123 - Advanced Statistics II (3)
STAT 7127 - Linear Statistical Models (3)
STAT 7133 - Multivariate Analysis (3)
STAT 7135 - Statistical Computation (3)
STAT 7137 - Survival Analysis (3)
STAT 7139 - Time Series Analysis (3)
MATH 5128 - Applied Probability I (3)
MATH 5129 - Applied Probability II (3)
MATH 7120 - Probability Theory I (3)
MATH 7121 - Probability Theory II (3)
MATH 7125 - Stochastic Processes I (3)

Group III - Algebra-Topology
MATH 5163 - Modern Algebra (3)
MATH 5164 - Abstract Linear Algebra (3)
MATH 5181 - Introduction to Topology (3)
MATH 7163 - Modern Algebra I (3)
MATH 7164 - Modern Algebra II (3)
MATH 7181 - Topology I (3)
MATH 7182 - Topology II (3)

Group IV - Analysis
MATH 5143 - Analysis I (3)
MATH 5144 - Analysis II (3)
MATH 7141 - Complex Analysis I (3)
MATH 7142 - Complex Analysis II (3)
MATH 7143 - Real Analysis I (3)
MATH 7144 - Real Analysis II (3)
MATH 7148 - Functional Analysis (3)

Group V - Mathematical Finance
MATH 6202 - Derivatives II: Partial Differential Equations for Finance (3)
MATH 6203 - Stochastic Calculus for Finance I (3)
MATH 6204 - Numerical Methods for Financial Derivatives (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)

Group VI - Computer Science
ITCS 5xxx - Computer Science Elective (3)
ITCS 6xxx - Computer Science Elective (3)

Degree Total = 30 Credit Hours

Assistantships
A number of graduate assistantships are available each year (with nationally-competitive stipends) for qualified applicants. A limited number of fellowship awards can be applied to supplement these stipends for especially qualified students.

Thesis
Completion of a thesis is optional. With the approval of the department Graduate Committee, a candidate may receive up to six of the 15 hours required at the 7000 level for the writing of a master's thesis on an approved topic. This thesis may be original work, work of an expository nature, or the mathematical formulation and solution of a particular industrial or business problem suggested by the career interests of the student. A candidate may receive no more than six of the hours required at the 7000 level for course and thesis work in another department. If the thesis option is selected, the candidate will be required to defend their thesis in an oral examination.

Comprehensive Examination
A candidate must perform satisfactorily on a written or oral comprehensive examination over their program of study. The thesis defense is the comprehensive examination for those students who select the thesis option.

Concentration in Applied Mathematics

The Master of Science in Mathematics with Concentration in Applied Mathematics program is designed to develop critical thinking, intuition, and advanced experience in the techniques of mathematical analysis and their application to the problems of industry and technology. Skills are developed to deal with technical problems encountered in industry, business, and government and to hold leadership positions therein; to teach Applied Mathematics at the undergraduate or community college level; and to potentially study Applied Mathematics leading to the Ph.D. degree.

Additional Admission Requirements
In addition to the general requirements for admission to the Graduate School, applicants for the Concentration in Applied Mathematics must present evidence of the satisfactory completion of at least 27 credit hours of mathematics approved by the department Graduate Committee.

Concentration Requirements

A candidate for the M.S. in Mathematics with Concentration in Applied Mathematics degree must complete at least 30 credit hours of graduate work approved by the department Graduate Committee to include:

Core Courses (21 credit hours)

MATH 5143 - Analysis I (3)
MATH 5144 - Analysis II (3)
MATH 5165 - Numerical Linear Algebra (3)

Numerical Analysis Courses

Select one of the following:
MATH 5171 - Numerical Solution of Ordinary Differential Equations (3)
MATH 5172 - The Finite Element Method (3)
MATH 5176 - Numerical Methods for Partial Differential Equations (3)

Advanced Analysis Courses

Select one of the following:
MATH 7141 - Complex Analysis I (3)
MATH 7143 - Real Analysis I (3)
MATH 7144 - Real Analysis II (3)

Advanced Applied Mathematics Courses

Select two of the following:
MATH 7172 - Partial Differential Equations (3)
MATH 7176 - Advanced Numerical Analysis (3)
MATH 7177 - Applied Optimal Control (3)
MATH 7178 - Computational Methods for Fluid Dynamics (3)
MATH 7179 - Advanced Finite Difference Methods (3)
MATH 7180 - Advanced Numerical Methods in Scientific Computing (3)
MATH 7273 - Advanced Finite Element Analysis (3)

Elective Courses (6 credit hours)

Advanced Elective Courses

Select one of the following:
MATH 7141 - Complex Analysis I (3)
MATH 7143 - Real Analysis I (3)
MATH 7144 - Real Analysis II (3)
MATH 7172 - Partial Differential Equations (3)
MATH 7176 - Advanced Numerical Analysis (3)
MATH 7177 - Applied Optimal Control (3)
MATH 7178 - Computational Methods for Fluid Dynamics (3)
MATH 7179 - Advanced Finite Difference Methods (3)
MATH 7180 - Advanced Numerical Methods in Scientific Computing (3)
MATH 7273 - Advanced Finite Element Analysis (3)
MATH 7994 - Master's Thesis Research (3)

Mathematics or Application Elective Courses

Select one Mathematics or suitable area of application course with the approval of the student's advisor.
Suggested electives include:
STAT 5123 - Applied Statistics I (3)
MEGR 6116 - Fundamentals of Heat Transfer and Fluid Flow (3)
MEGR 6141 - Theory of Elasticity I (3)
MEGR 7112 - Radiative Heat Transfer (3)
MEGR 7114 - Advanced Fluid Mechanics (3)

Directed Project (3 credit hours)

All candidates for the degree concentration must complete three hours of a Directed Project in Mathematics course in which they carry out an independent project under the supervision of a member of the graduate faculty. The project could involve a specific application to a concrete problem of techniques identified in the literature or studied in other courses. All projects are subject to prior approval of the department Graduate Committee and must be successfully defended before a committee of three graduate faculty members appointed by the department Graduate Committee.

MATH 7892 - Directed Project in Mathematics (1 to 3)

Degree Total = 30 Credit Hours

Assistantships

A number of graduate assistantships are available each year (with nationally-competitive stipends) for qualified applicants. A limited number of fellowship awards can be applied to supplement these stipends for especially qualified students.

Thesis

A student may choose to expand the work begun in MATH 7892 into a master's thesis by registering for 3 credit hours of MATH 7994 to fulfill the advanced elective course requirement described above. This thesis option affords the student the opportunity to do professional/scholarly work demonstrating proficiency in the area of Applied Mathematics.

Comprehensive Examination

Each candidate for the degree concentration in Applied Mathematics must perform satisfactorily on a final comprehensive examination. This examination will be set and administered by a committee appointed by the department Graduate Committee. It may be in either written or oral form, and it will cover those areas of study and/or research deemed appropriate by the committee. The thesis defense is the comprehensive examination for those students who select the thesis option.

Concentration in Mathematics Education

The Master of Science in Mathematics with Concentration in Mathematics Education degree program is designed primarily for secondary school mathematics teachers interested in professional growth in mathematics teaching. Emphasis in this program is given to developing depth and breadth in mathematics teaching and learning, appropriate to the role of the secondary school teacher.

By the end of their first semester in the program, each student will select a member of the Mathematics Education faculty to serve as their Graduate Advisor throughout the program. Approval of the program of each student and provision of advice regarding progress toward the degree are the responsibility of the Graduate Advisor.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for graduate study in Mathematics Education:

1) Twenty-seven hours of undergraduate coursework in Mathematics beyond the freshman level, or evidence of equivalent academic preparation.
2) Possession of a North Carolina "A" teacher's license or the equivalent from another state is preferred.
3) Two years of full-time experience teaching mathematics in a secondary school or other acceptable teaching experience.

Concentration Requirements

Candidates for the M.S. in Mathematics with Concentration in Mathematics Education degree must complete a minimum of 33 credit hours of graduate coursework or the equivalent. Of these, 18 credit hours must be in courses numbered 6000 or above. Programs of study beyond these 33 credit hours may be required to remove deficiencies in undergraduate programs or to develop areas of need, interest, or desired experience.

Core Courses (15 credit hours)

MATH 5109 - History of Mathematical Thought (3)
MATH 6101 - Foundations of Mathematics (3)
MATH 6102 - Real Analysis for Secondary Mathematics Teachers (3)
MATH 6108 - Probability and Statistics for Secondary Mathematics Teachers (3)
or STAT 6108 - Probability and Statistics for Secondary Mathematics Teachers (3)
MATH 6118 - Non-Euclidean Geometry (3)

Mathematical Foundations and Algebra Courses (6 credit hours)

Select two of the following:
MATH 5161 - Number Theory (3)
MATH 6106 - Modern Algebra for Secondary Mathematics Teachers (3)
MATH 6107 - Linear Algebra for Secondary Mathematics Teachers (3)

Mathematics Education Courses (9 credit hours)

Students take graduate-level courses covering mathematics education learning theory, research, and contemporary topics in secondary mathematics teaching.

MAED 6122 - Theoretical Foundations of Learning Mathematics (3)
MAED 6123 - Research in Mathematics Education (3)
MAED 6124 - Issues in the Teaching of Secondary School Mathematics (3)

Professional Education Course (3 credit hours)

MDSK 6260 - Teacher Leadership (3)

Degree Total = 33 Credit Hours

Basic Portfolio

Each student must complete a Basic Portfolio consisting of documents and artifacts that provides evidence of the student's professional growth during the program.

Substitutions to satisfy any of the Concentration Requirements must be approved by the Graduate Advisor and the Mathematics Education Coordinator.

Comprehensive Examination

Upon successful completion of all coursework, each candidate for the M.S. in Mathematics with Concentration in Mathematics Education degree is required to demonstrate that they have met the program goals in an oral presentation consisting of two parts. In the first part, the student answers questions from the faculty that focus on the mathematics content courses. The second part of the exam involves the student presenting documentation that demonstrates their professional growth as teachers and educational researchers. The student has the option of presenting either a research-based project or a comprehensive portfolio. The Graduate Advisor advises and assists the student in planning their Comprehensive Portfolio or Final Research Report.

Concentration in Actuarial Statistics

The Master of Science in Mathematics with Concentration in Actuarial Statistics provides advanced skills and knowledge to individuals seeking actuarial careers in insurance and financial institutions. In addition to acquiring statistical and computational skills, the required courses for this concentration are designed to prepare students to pass a series of examinations needed to earn an Actuarial Designation with the Society of Actuaries or the Casualty Actuarial Society.

Additional Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for the Concentration in Actuarial Statistics:

- 9 credit hours of calculus at the level of MATH 1241, MATH 1242, and MATH 2241
- 3 credit hours of linear algebra at the level of MATH 2164
- Applicants must present evidence of undergraduate preparation in basic actuarial science including:
  - 6 credit hours of probability courses at the level of MATH 3122 or STAT 3122 and MATH 3123 or STAT 3123 with a grade of B or above, or passing the SOA Exam P
  - 6 credit hours of financial mathematics courses at the level of MATH 2228 and MATH 3228 with a grade of B or above, or passing the SOA Exam FM
  - 6 credit hours of statistics courses at the level of STAT 3110 and STAT 3150 with a grade of B or above

Concentration Requirements

Core Courses (18 credit hours)

The following required courses prepare students for Actuarial Exams IFM (Investment and Financial Markets), LTAM (Long-Term Actaurial Mathematics), STAM (Short-Term Actuarial Mathematics), and SRM (Statistics for Risk Modeling). Note that Actuarial Exam P (Probability) and FM (Financial Mathematics) are taught at the undergraduate level.

MATH 5226 - Mathematics of Financial Markets (3)
MATH 5228 - Actuarial Science IIA (3)
MATH 5229 - Actuarial Science IIB (3)
STAT 5123 - Applied Statistics I (3)
STAT 6115 - Statistical Learning with Big Data (3)
STAT 6228 - Short-Term Actuarial Mathematics (3)

Elective Courses (12 credit hours)

Select from the following with at least 6 credit hours in MATH or STAT courses:
MATH 6203 - Stochastic Calculus for Finance I (3)
MATH 6205 - Financial Computing (3)
MATH 6206 - Stochastic Calculus for Finance II (3)
STAT 5124 - Applied Statistics II (3)
STAT 7127 - Linear Statistical Models (3)
STAT 7133 - Multivariate Analysis (3)
STAT 7135 - Statistical Computation (3)
STAT 7139 - Time Series Analysis (3)
FINN 6152 - Financial Management (3)
FINN 6153 - Investment Management (3)
FINN 6203 - Financial Economic Theory (3)
FINN 6214 - Asset and Portfolio Management (3)
FINN 6219 - Financial Econometrics (3)
ITCS 6114 - Algorithms and Data Structures (3)

Note: Other courses may be considered with permission of the department.

Capstone Requirement

Students in the M.S. in Mathematics with Concentration in Actuarial Statistics may select one of the following options as their Capstone Requirement:

Directed Project

Students who select this option complete 3 credit hours of MATH 7892 or STAT 7892 in which they carry out an independent project under the supervision of a member of the graduate faculty. If the project option is selected, the candidate is required to defend their project before a committee of three graduate faculty members appointed by the department Graduate Committee.

Comprehensive Examination

Each candidate for the Concentration in Actuarial Statistics must perform satisfactorily on a final comprehensive examination. This examination is set and administered by a committee appointed by the department Graduate Committee. It may be in either written or oral form, and it covers those areas of study on the Long-Term and Short-Term Actuarial Mathematics, including MATH 5229 and STAT 6228. The research seminar project defense is the comprehensive examination for those students who select the research seminar option.

Grade Requirements

Students must receive a grade of B or above for this concentration.

Degree Total = 30 Credit Hours

Concentration in Applied Statistics

The Master of Science in Mathematics with Concentration in Applied Statistics program is designed to provide advanced skills and knowledge in the planning, design, testing, and implementation of statistical methods. Skills are developed to deal with problems encountered in statistical applications in business, industry, and government; to hold administrative positions requiring planning and implementation of statistical analysis; to teach statistics at the undergraduate or community college level; and to potentially study statistics leading to the Ph.D. degree.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for the concentration in Applied Statistics:

1) An overall GPA of at least 3.0 on all previous college work including a GPA of at least 3.0 in courses prerequisite to the area of applied statistics.
2) Evidence of undergraduate preparation in mathematics and computer science including: 12 credit hours of calculus at the level of MATH 1241, MATH 1242, MATH 2241, and MATH 2242; 3 credit hours of linear algebra at the level of MATH 2164; 3 credit hours of differential equations at the level of MATH 2171; 6 credit hours of probability and statistics at the level of MATH 3122 and MATH 3123; and 3 credit hours of computer programming at the level of ITCS 1214.

Concentration Requirements

A candidate for the M.S. in Mathematics with Concentration in Applied Statistics degree must complete a minimum of 33 credit hours of graduate work approved by the department Graduate Committee, including:

Core Courses (21 credit hours)

STAT 5123 - Applied Statistics I (3)
STAT 5124 - Applied Statistics II (3)
STAT 5126 - Theory of Statistics I (3)
STAT 5127 - Theory of Statistics II (3)
STAT 7027 - Topics in Statistics (3)
STAT 7127 - Linear Statistical Models (3)
STAT 7133 - Multivariate Analysis (3)

Note: Students who, because of their undergraduate work or other experience, can demonstrate sufficient knowledge of the material in one or more of the core courses may be exempted from taking a course or courses. Exemption from a course carries no credit towards the degree concentration.

Elective Courses (9 credit hours)

MATH/STAT or Applied Elective Courses

Select two courses from an approved list. Examples include:

MATH 5128 - Applied Probability I (3)
MATH 5129 - Applied Probability II (3)
MATH 5143 - Analysis I (3)
MATH 5165 - Numerical Linear Algebra (3)
MATH 7120 - Probability Theory I (3)
MATH 7121 - Probability Theory II (3)
MATH 7143 - Real Analysis I (3)
STAT 6115 - Statistical Learning with Big Data (3)
STAT 7027 - Topics in Statistics (3)
STAT 7135 - Statistical Computation (3)
STAT 7137 - Survival Analysis (3)
STAT 7139 - Time Series Analysis (3)
STAT 7891 - Independent Study in Statistics (1 to 3)

MATH or STAT Elective Course

Select one of the following:

MATH 7xxx - Mathematics Elective (3)
STAT 7xxx - Statistics Elective (3)

Directed Project (3 credit hours)

All candidates for the M.S. in Mathematics with Concentration in Applied Statistics degree are required to complete 3 credit hours of a Directed Project in Statistics in which they carry out an independent project under the supervision of a member of the graduate faculty. The project could involve a specific application of techniques identified in the literature or studied in other courses. All projects are subject to the prior approval of the department Graduate Committee and must be successfully defended before a committee of three graduate faculty members appointed by the department Graduate Committee.

STAT 7892 - Directed Project in Statistics (1 to 3)

Degree Total = 33 Credit Hours

Assistantships

A number of graduate assistantships are available each year (with nationally-competitive stipends) for qualified applicants. A limited number of fellowship awards can be applied to supplement these stipends for especially qualified students.

Thesis

A student may choose to expand the work begun in STAT 7892 into a master's thesis by registering for 3 credit hours of MATH 7994 to fulfill the MATH/STAT 7000-level elective course requirement above. This thesis option affords the student the opportunity to do professional and scholarly work demonstrating proficiency in the area of applied statistics.

Comprehensive Examination

Each candidate for the M.S. in Mathematics with Concentration in Applied Statistics degree must perform satisfactorily on an oral comprehensive examination over the candidate's program of study. The thesis defense is the oral comprehensive examination for those students who select the thesis option.

NANOSCALE SCIENCE

- Ph.D. in Nanoscale Science

Graduate Program
nanoscalescience.charlotte.edu

Ph.D. in Nanoscale Science

The Ph.D. in Nanoscale Science is an interdisciplinary program that addresses the development, manipulation, and use of materials and devices on the scale of roughly 1-100 nanometers in length (larger for bio nanomaterials), and the study of phenomena that occur on this size scale. The program prepares students to become scholarly, practicing scientists who possess the technical, critical thinking, and communication skills needed to advance and disseminate knowledge of fundamental and applied nanoscale science.

The many challenges and opportunities nanoscale science presents to society require collaborative, interdisciplinary approaches to research. Students enrolled in UNC Charlotte's Nanoscale Science Ph.D. program learn about the exciting field of nanoscale science from the perspectives of faculty members trained in numerous types of disciplines, and they learn how to work effectively with scientists and engineers, from various fields, on cutting-edge research projects.

Students in the program acquire the knowledge, skills, and credentials needed to compete effectively for many types of positions by completing interdisciplinary nanoscale science courses and elective courses, participating in program colloquia and seminars, and by making research contributions independently and as part of a team. Graduates of our program are gainfully employed in academic, industrial, and government positions.

Admission Requirements
The following are general guidelines for successful admission into the Ph.D. program in Nanoscale Science:

1.) A bachelor's or master's degree in a science or engineering discipline relevant to nanoscale science is required for admission to full standing in the Nanoscale Science Ph.D. program.
2.) A minimum undergraduate GPA of 3.0 or, if the applicant is currently enrolled in a graduate program or has earned a master's degree, a minimum grade point average of 3.0 in a relevant science or engineering master's program.
3.) Three strong, positive letters of recommendation, at least two of which should come from faculty in the applicant's current or previous academic program. All letters should be written by individuals in a position capable of judging the applicant's likely success in a Ph.D. level program. Letters should address the applicant's suitability for a Ph.D. program and ability to complete the program in a timely manner.
4.) Admission of students who are not native English speakers will require strong scores on the TOEFL exam. The TOEFL exam is a required part of the application for non-native English speakers.

Documents To Be Submitted For Application For Admission
1.) Official transcripts from all colleges and universities attended (indicating completion of a bachelor's degree in a relevant science or engineering discipline)
2.) The UNC Charlotte application for graduate admission form
3.) Three letters of reference from academics who have taught or worked directly with the applicant
4.) An essay that addresses professional goals and motivation for pursuing the degree, suitability for the program, and career goals following the program
5.) TOEFL scores (if the applicant is not a native English speaker)

Note: Standardized test scores (e.g., GRE, MAT) are not required.

Admissions Assessment
An admissions committee will review applications and recommend to the Program Director whether each applicant should be admitted and, if so, under what conditions.

Degree Requirements
The Ph.D. in Nanoscale Science requires 72 credit hours. Core courses account for at least 27 credit hours, elective courses account for at least 6 credit hours, and dissertation research accounts for at least 18 credit hours. The remaining credit hours are fulfilled by enrolling in a combination of restricted elective courses. Students may count other courses towards meeting the 72 credit hour requirement with approval of the Graduate Program Director.

General Science Proficiency Exam (GSPE)
The purpose of the GSPE is to ensure that students possess a working knowledge of material needed to master concepts in nanoscale science. The exam covers introductory material in chemistry, physics, and mathematics (including calculus). The exam is administered three times per year - in August (during Orientation Week), January, and May. After taking the GSPE, students meet with the GSPE Administrator to discuss exam results and how to address any deficiencies. Students who do

not pass the GSPE by the end of their first year of enrollment will be terminated from the program.

Core Courses (27 credit hours)
NANO 8001 - Perspectives at the Nanoscale (2)
NANO 8101 - Introduction to Instrumentation and Processing at the Nanoscale (3)
NANO 8102 - Nanoscale Phenomena (3)
NANO 8103 - Synthesis and Characterization of Nanomaterials (3)
NANO 8105 - Life at the Nanoscale (3)
NANO 8203 - Collaborative Research Proposal (3)
NANO 8301 - Nanomedicine (3)
or NANO 8351 - Nanoscale Materials for Energy Applications (3)
NANO 8681 - Nanoscale Science Seminar (1) *
NANO 8682 - Nanoscale Science Colloquium (1) **

** Students must enroll in NANO 8681 during every semester in residence, except when enrolled in GRAD 9800 or GRAD 9999, for a minimum of four semesters.*

*** Students must enroll in NANO 8682 during the three semesters immediately following enrollment in NANO 8001.*

Elective Courses (6 credit hours)
In addition to completing the Core Courses, students must complete a minimum of 6 credit hours of Elective Courses. Elective Courses are selected in consultation with the student's advisor (normally the dissertation advisor) to best meet the student's needs and interests. Any of the following courses may be used to meet elective requirements:

BIOL 7000-8999 - Biological Sciences Elective
CHEM 7000-8999 - Chemistry Elective
ECGR 7000-8999 - Electrical and Computer Engineering Elective
MEGR 7000-8999 - Mechanical Engineering Elective
OPTI 7000-8999 - Optical Science Elective
PHYS 7000-8999 - Physics Elective

Other courses may be used to satisfy elective requirements, provided that prior approval has been obtained from the Graduate Program Director. Students may count one 5000 level course towards meeting elective requirements if approved in advance by the Graduate Program Director.

Dissertation Research (18 credit hours)
Students must complete a minimum of 18 credit hours of the following:
NANO 8900 - Dissertation Research (1 to 4)

Additional Coursework (21 credit hours)
The remaining 21 credit hours are fulfilled by enrolling in any combination of the following courses. Students may count other courses towards meeting the 72 credit hour requirement with approval of the Graduate Program Director.

NANO 8400 - Nanoscale Science Internship (1 to 9)
NANO 8681 - Nanoscale Science Seminar (1)
NANO 8900 - Dissertation Research (1 to 4)
NANO 8000-8999 - Nanoscale Science Elective
BIOL 7000-8999 - Biological Sciences Elective
CHEM 6150 - Seminar-Internship (1 to 3)
CHEM 7000-8999 - Chemistry Elective
ECGR 7000-8999 - Electrical and Computer Engineering Elective
MEGR 7000-8999 - Mechanical Engineering Elective
OPTI 7000-8999 - Optical Science Elective
PHYS 7000-8999 - Physics Elective

Degree Total = 72 Credit Hours

Grade Requirements
Graduate students must have a GPA of 3.2 or higher to graduate from the program. Two grades of C or one grade of U will result in termination from the program.

Admission to Candidacy Requirements
The Graduate School requires doctoral students to pass a qualifying examination, and to advance to candidacy by successfully defending a dissertation topic proposal at a meeting of the student's advisory/dissertation committee. Because of its emphasis on proposal writing and development, the Nanoscale Science Ph.D. program links the qualifying examination with the dissertation topic proposal defense. Before the third semester in residence, each student (in consultation with their research advisor) chooses a preliminary dissertation committee that should normally include four faculty members (counting the student's dissertation advisor) who the student expects will provide valuable scientific input based on their areas of expertise (Note: The Graduate Faculty Representative is not appointed at this stage, hence this is a preliminary dissertation committee). Members of the preliminary dissertation committee must have Graduate Faculty status and be affiliated with the Nanoscale Science Ph.D. program. Students are encouraged to begin the qualifying exam / dissertation topic proposal process towards the end of their fourth semester in residence. The process begins when the student submits a written proposal for dissertation research that is distributed to the preliminary dissertation committee. Within two weeks after the proposal is submitted, the preliminary dissertation committee develops a written qualifying exam that is administered to the student. The exam questions should be related to the student's proposal, and they may also be

related to the student's coursework as it applies to areas associated with the proposed dissertation project or the student's research group. The student is given one week to complete the exam. Once the student has passed the exam, an oral defense of the dissertation topic proposal is conducted in a meeting with the student's full dissertation committee (including the Graduate School Representative). A student who does not pass the qualifying exam may take it one more time; likewise, a student who does not pass the dissertation topic proposal defense may have a second chance to succeed. Students are encouraged to complete the qualifying exam and dissertation topic proposal defense before the fifth semester in residence; under normal circumstances they must complete both requirements before the beginning of the sixth semester in residence.

Advising/Committees

The Graduate Program Director serves as the student's academic advisor until a research advisor is chosen (normally before the beginning of the second semester in residence). Once selected, the research advisor will serve as the student's academic advisor. The Graduate Program Director is responsible for monitoring student progress. Students must obtain the Graduate Program Director's permission to enroll in any courses. Students are encouraged to form a dissertation committee (minus the Graduate School representative), as soon as possible after selecting a research advisor, and to consult regularly with the committee members on research and academic progress. The aforementioned committee will administer the Qualifying Exam to the student. Once the student passes the Qualifying Exam, the Graduate School Representative will be appointed to complete the dissertation committee.

Application for Degree

Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar. After successful defense of the dissertation, a student will be conferred with the doctoral degree.

Residency Requirement

Students must satisfy the residency requirement for the program by completing 21 credit hours of continuous enrollment, such as coursework or dissertation credits. Residence is considered continuous if the student is enrolled in one or more courses in successive semesters until 21 credit hours are earned.

Time Limits for Completion

The student must achieve admission to candidacy within six years after admission to the program. All requirements for the degree must be completed within nine years after initial registration as a doctoral student. These time limits are considered to be maxima; full-time students are typically expected to complete their degree requirements within 4-5 years of initial registration as a Nanoscale Science Ph.D. student.

Transfer Credit

Students who have completed graduate coursework but have not earned a graduate degree may transfer up to 6 credit hours of coursework. Students who have earned a Master's degree may transfer up to 30 credit hours of coursework. Students who wish use transfer coursework credits towards meeting degree requirements for the Nanoscale Science Ph.D. should consult with the Graduate Program Director as soon as possible.

OPTICAL SCIENCE AND ENGINEERING

- Ph.D. in Optical Science and Engineering
- M.S. in Optical Science and Engineering

Graduate Program

optics.charlotte.edu

The M.S. and Ph.D. programs in Optical Science and Engineering are interdisciplinary, involving primarily five science and engineering departments (Departments of Physics & Optical Science, Chemistry, Mathematics & Statistics, Electrical & Computer Engineering, and Mechanical Engineering & Engineering Science) and four centers (Center for Optoelectronics & Optical Communications, Center for Metamaterials, Center for Freeform Optics, and Center for Precision Metrology). The program is administered through the Department of Physics and Optical Science. The purpose of the program is to educate scientists and engineers who will develop the next generation of optical technology. The program emphasizes basic and applied interdisciplinary education and research in the following specialties of optics:

- Micro-optics and nanophotonics
- Fiber and integrated optics
- Optoelectronic materials and devices
- Biomedical optics
- Optical interferometry and metrology
- Optical fabrication
- Nanoscale imaging and spectroscopy
- Adaptive optics
- Optical communication
- Novel light-matter interactions
- Quantum optics
- Optical sensors and measurements

A complete description of the research activity within the Optical Science and Engineering program can be accessed online at optics.charlotte.edu.

Ph.D. in Optical Science and Engineering

Admission Requirements

All applicants seeking admission into the Optical Science and Engineering Ph.D. program must fulfill the IUniversity's general requirements for graduate admission at the Ph.D. level. Additional requirements for admission into the program are:

- A baccalaureate or master's degree in Physics, Chemistry, Mathematics, Engineering, Optics, or a related field
- Minimum undergraduate GPA of 3.0 overall and 3.2 (on a scale of 4.0) in the major (if a candidate presents a master's degree at application, a minimum graduate GPA of 3.2 on all graduate work is required)
- A minimum combined score of 301 on the verbal and quantitative portions of the GRE General Test (no subject test is required)
- Positive letters of recommendation
- Students may be required to take undergraduate courses determined by the Interdisciplinary Optics Program Committee on an individual basis; such courses will be specified at the time of admission into the program

GRE Waiver

The GRE General Test requirement is waived for applicants who have graduated from UNC Charlotte within the past three years and earned a minimum 3.4 GPA in the major. The GRE General Test is also waived for applicants who are currently enrolled in the M.S. in Optical Science and Engineering or M.S. in Applied Physics at UNC Charlotte.

Documents to Submit for Admission

- UNC Charlotte online application for graduate admission
- Official GRE scores
- Official TOEFL or IELTS score from international applicants whose native language is not English, unless the previous degree was from a country where English is the official language
- Unofficial transcripts from all colleges and universities attended should be uploaded to the application (Applicants offered admission will be required to submit official transcripts)
- A minimum of three letters of reference
- A Statement of Purpose essay detailing the applicant's motivation and career goals

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Ph.D. in Optical Science and Engineering is awarded for completion of scholarly research that advances the knowledge base in the field and is demonstrated by a successful dissertation defense. Additionally, recipients of this degree should demonstrate mastery of relevant subject matter and a potential for success in future research and teaching.

The minimum requirement for the Ph.D. degree in Optical Science and Engineering is 72 credit hours beyond the baccalaureate degree.

Each candidate for the Ph.D. degree in Optical Science and Engineering must complete the following:

- Present evidence of competency in the core curriculum by successfully completing 18 of 21 credit hours of core courses with a grade of B or above in each course
- A minimum of 9 credit hours of elective OPTI courses in addition to the core curriculum
- 1 credit hour of OPTI 8610 (Seminar) during the Fall semester of the first academic year in the program
- 1 credit hour of OPTI 8611 (Graduate Colloquium) during the Spring semester for the first academic year in the program and 1 credit hour of OPTI 8611 each subsequent academic year in the program
- A minimum of 24 credit hours of OPTI 8991 (Dissertation Research)
- The remaining credit hours may be dissertation research credits, elective courses, or a combination
- Successfully complete the written and oral qualifying exam
- Select a dissertation advisor and form an advisory committee
- Prepare a plan of study detailing how you intend to satisfy the 72 credit hour requirement
- Successfully submit a Ph.D. research proposal
- Successfully defend the Ph.D. dissertation

Core Curriculum (18 credit hours)

All graduates of the program must demonstrate competency in the core curriculum. Students may do so by completing 18 of the 21 available credit hours of core courses with a grade of B or above in each course. The course makeup of the 18 credit hours, changing the course makeup, or withdrawing from a core course must be approved by the academic advisor or program director. Competency is typically demonstrated by the end of the 3rd semester in the program. With program director approval, students may demonstrate competency by passing a core competency exam. Credit hours that would have been earned if the student had taken the course may be replaced by dissertation research or an approved elective.

Select from the following:

OPTI 8101 - Mathematical Methods of Optical Science and Engineering (3)
OPTI 8102 - Principles of Geometrical Optics (3)
OPTI 8102L - Geometrical Optics Lab (1)
OPTI 8103 - Light Sources and Detectors (3)
OPTI 8104 - Electromagnetic Waves (3)
OPTI 8105 - Optical Properties of Materials (3)
OPTI 8106 - Principles of Physical Optics (3)
OPTI 8106L - Physical Optics Lab (2)

OPTI Elective Courses (9 credit hours)

Select OPTI courses in addition to the OPTI courses in the Core Curriculum.

Seminar Course (1 credit hour)

To be taken during the Spring semester of the first academic year in the program:

OPTI 8610 - Seminar (1)

Colloquium Courses

To be taken each subsequent academic semester in the program, following the Seminar Course:

OPTI 8611 - Graduate Colloquium (1)

Dissertation Research Course (24 credit hours)

Complete a minimum of 24 credit hours of dissertation research.

OPTI 8991 - Dissertation Research (1 to 3)

Elective Courses

The remaining credit hours of the program may be dissertation research credits, elective courses, or a combination. Elective courses must be approved by the academic advisor and may include courses having a prefix of OPTI, PHYS, ECGR, MEGR, and NANO. Other courses may be considered as well. Ph.D. students should enroll in 8000-level courses when possible.

Degree Total = 72 Credit Hours

Grade Requirements

Students in the Ph.D. program must maintain a minimum cumulative GPA of 3.0 in all coursework attempted for the degree. An accumulation of two C grades will result in suspension from the program. A grade of U earned in any course will result in suspension from the program. An accumulation of three C grades or two U grades will result in closure of the student's enrollment in the program..

Application for Degree

Students should submit an Application for Degree at the

beginning of the term in which they anticipate defending their dissertation. Adherence to Graduate School deadlines is expected. Degree requirements are completed when students successfully defend their dissertation and file the final copy of the dissertation in the Graduate School.

Assistantships

Support for beginning graduate students is usually a teaching assistantship. Continuing students are usually supported by research assistantships.

Dissertation

Each student will complete a minimum of 24 credit hours of dissertation research. The student must submit a written dissertation for final review to the advisory committee three weeks before the defense date. The student must defend the dissertation before the advisory committee at a presentation which is open to the University community. Upon approval of the written dissertation and oral presentation by the advisory committee, the student has successfully completed the dissertation requirement. The dissertation must be written using a format acceptable to the Graduate School.

Dissertation Advisor and Advisory Committee

Each student in the program must have a dissertation advisor and an advisory committee. The program director serves as academic advisor until the student selects a dissertation advisor. The student selects the dissertation advisor by submitting a Dissertation Advisor Form. The student should select the advisor before the end of the second year of residency. The student and advisor determine the committee by agreement. The advisor serves as chair of the committee and must be a member of the Optics Faculty and a regular member of the Graduate Faculty at UNC Charlotte. The Dean of the Graduate School appoints a committee member to serve as the Graduate Faculty Representative. The committee must have at least 4 members, one of whom is the chair and one of whom is the Graduate Faculty Representative. All members of the committee must be members of the Graduate Faculty and a majority must be members of the Optics Faculty. Composition of the advisory committee must be approved by the Optics Program Director and the Dean of the Graduate School.

Qualifying Exam

Students participate in a written and oral qualifying examination administered by the optics faculty during the third semester of enrollment in the program. If a student fails the qualifying examination, it may be retaken once. If a student fails the exam a second time, the student's enrollment in the Ph.D. program will be closed.

Plan of Study

All students should prepare a plan of study before the end of their fourth semester following admission to the program. The plan of study shows in detail how the student intends to meet the degree requirements. The plan of study must be approved by the advisory committee and the optics program director.

Research Proposal

After successful demonstration of competency in the core curriculum and approval of the plan of study, the student will prepare a written research proposal and present an oral defense of the proposal to their advisory committee. This should be completed within three years following admission to the program. The research proposal, also called the dissertation topic proposal, must be approved by the advisory committee. The research proposal demonstrates the student's knowledge of the relevant literature and the specific research problems and methods of study that, if successfully completed, will lead to an acceptable dissertation.

Residency Requirement

The student must satisfy the residence requirement for the program by completing 20 credit hours of continuous enrollment in coursework/dissertation credit. Residence is considered continuous if the student is enrolled in one or more courses in successive semesters until 20 credit hours are earned.

Responsible Conduct of Research

UNC Charlotte is committed to ensuring that doctoral students understand their obligations as researchers. All first year doctoral students in science, math, engineering, or technology are required to enroll in GRAD 8302 (Responsible Conduct of Research). This two credit hour course prepares students for a range of research related issues.

Transfer Credit

Up to 30 credit hours of approved coursework may be transferred from a master's and/or doctoral program from a college or university accredited by an accepted accrediting body. Only courses in which the student earned a grade of B or above (or its equivalent) can be transferred. No more than 6 credit hours of approved coursework taken as a post-baccalaureate student may be applied toward the degree. Credit for dissertation research cannot be transferred.

M.S. in Optical Science and Engineering

Admission Requirements

All applicants seeking admission into the M.S. in Optical Science and Engineering program must fulfill the University's general requirements for graduate admission at the Master's level. Additional requirements for admission into the program are:

- A baccalaureate or master's degree in Physics, Chemistry, Mathematics, Engineering, Optics, or a related field
- Minimum undergraduate GPA of 3.0 overall and 3.0 (on a scale of 4.0) in the major
- A minimum combined score of 293 on the verbal and quantitative portions of the GRE revised General Test
- Positive letters of recommendation
- Students may be required to take undergraduate courses determined by the Interdisciplinary Optics Program Committee on an individual basis; such courses will be specified at the time of admission into the program

Documents to Submit for Admission

- UNC Charlotte online application for graduate admission
- Official GRE scores
- Official TOEFL or IELTS score from international applicants whose native language is not English, unless the previous degree was from a country where English is the official language
- Unofficial transcripts from all colleges and universities attended should be uploaded to the application (Applicants offered admission will be required to submit official transcripts)
- A minimum of three letters of reference
- A Statement of Purpose essay detailing the applicant's motivation and career goals

GRE Waiver

The GRE General Test requirement is waived for applicants who have graduated from UNC Charlotte within the past three years and earned a minimum 3.4 GPA in the major.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements (Non-Thesis Option)

The Master of Science degree with non-thesis option in Optical Science and Engineering is awarded for completion of formal coursework, demonstration of competency in the core curriculum, and successful completion of the written and oral comprehensive examination.

The program director serves as academic advisor for each student in a program of study with the non-thesis option. The minimum requirement for the M.S. degree with non-thesis option is 32 credit hours beyond the baccalaureate degree. Each candidate for the M.S. degree with non-thesis option must complete the following and prepare a plan of study detailing how they intend to satisfy the 32 credit hour requirement.

Core Curriculum (15 credit hours)

All graduates of the program must demonstrate competency in the core curriculum. Students may do so by completing 15 of the 21 available credit hours of core courses with a grade of B or above in each course. The course makeup of the 15 credit hours, changing the course makeup, or withdrawing from a core course must be approved by the academic advisor or program director. Competency is typically demonstrated by the end of the 3rd semester in the program. With program director approval, students may demonstrate competency by passing a core competency exam. Credit hours that would have been earned if the student had taken the course may be replaced by approved credit hours.

Select from the following:

OPTI 6101 - Mathematical Methods of Optical Science and Engineering (3)
OPTI 6102 - Principles of Geometrical Optics (3)
OPTI 6102L - Geometrical Optics Lab (1)
OPTI 6103 - Light Sources and Detectors (3)
OPTI 6104 - Electromagnetic Waves (3)
OPTI 6105 - Optical Properties of Materials (3)
OPTI 6106 - Principles of Physical Optics (3)
OPTI 6106L - Physical Optics Lab (2)

Plan of Study

After successful demonstration of competency in the core curriculum, students should prepare a plan of study which shows in detail how the student will meet the degree requirements. The plan of study must be approved by the optics program director.

Elective Courses (15 credit hours)

Elective courses must be approved by the academic advisor and may include courses having a prefix of OPTI, PHYS, ECGR, MEGR, and NANO. Other courses may be

considered as well. M.S. students should enroll in 6000-level courses when possible.

Seminar Course (1 credit hour)

To be taken during the Fall semester of the first academic year in the program:

OPTI 6610 - Seminar (1)

Colloquium Course (1 credit hour)

To be taken during the Spring semester of the first academic year in the program:

OPTI 6611 - Graduate Colloquium (1)

Comprehensive Examination

Each student in a program of study with the non-thesis option will participate in the written and oral comprehensive examination administered by the optics faculty no later than the semester following the successful demonstration of competency in the core curriculum.

Degree Total = 32 Credit Hours

Degree Requirements (Thesis Option)

The Master of Science degree in Optical Science and Engineering with thesis option is awarded for completion of scholarly research that advances the knowledge base in the field and is demonstrated by a successful thesis defense.

The minimum requirement for the M.S. degree with thesis option is 32 credit hours beyond the baccalaureate degree. Each candidate for the M.S. degree with non-thesis option must complete the following and prepare a plan of study detailing how they intend to satisfy the 32 credit hour requirement.

Additionally, for the thesis option, students must:

- Select a thesis advisor and form an advisory committee
- Successfully submit an M.S. research proposal
- Successfully defend the M.S. thesis

Core Curriculum (15 credit hours)

All graduates of the program must demonstrate competency in the core curriculum. Students may do so by completing 15 of the 21 available credit hours of core courses with a grade of B or above in each course. The course makeup of the 15 credit hours, changing the course makeup, or withdrawing from a core course must be approved by the academic advisor or program director. Competency is typically demonstrated by the end of the 3rd semester in the program. With program director approval, students may demonstrate competency by passing a core competency exam. Credit hours that would have been earned if the student had taken the course may be replaced by approved credit hours.

Select from the following:

OPTI 6101 - Mathematical Methods of Optical Science and Engineering (3)
OPTI 6102 - Principles of Geometrical Optics (3)
OPTI 6102L - Geometrical Optics Lab (1)
OPTI 6103 - Light Sources and Detectors (3)
OPTI 6104 - Electromagnetic Waves (3)
OPTI 6105 - Optical Properties of Materials (3)
OPTI 6106 - Principles of Physical Optics (3)
OPTI 6106L - Physical Optics Lab (2)

Plan of Study

After successful demonstration of competency in the core curriculum, students should prepare a plan of study which shows in detail how the student will meet the degree requirements. The plan of study must be approved by the optics program director.

Elective Courses (6 credit hours)

Elective courses must be approved by the academic advisor and may include courses having a prefix of OPTI, PHYS, ECGR, MEGR, and NANO. Other courses may be considered as well. M.S. students should enroll in 6000-level courses when possible.

Seminar Course (1 credit hour)

To be taken during the Fall semester of the first academic year in the program:

OPTI 6610 - Seminar (1)

Colloquium Course (1 credit hour)

To be taken during the Spring semester of the first academic year in the program:

OPTI 6611 - Graduate Colloquium (1)

Thesis Requirements

Thesis Advisor and Advisory Committee

Each student in a program of study with the thesis option must have a thesis advisor and an advisory committee. The program director serves as the academic advisor for each student in a program of study with the thesis option until the student selects a thesis advisor. The student selects the thesis advisor by submitting a Thesis Advisor Form. The student should select the advisor before the end of the first year of residency. The student and advisor determine the advisory committee by agreement. The advisor serves as chair of the advisory committee and must be a member of the Optics Faculty and a regular member of the Graduate Faculty at UNC Charlotte. The advisory committee must have at least 3 members, one of whom is the chair. All members of the committee must be members of the Graduate Faculty, and a majority must

be members of the Optics Faculty. Composition of the advisory committee must be approved by the optics program director.

Thesis Research Proposal
After successful demonstration of competency in the core curriculum, a student in a program of study that includes the thesis option will prepare a written research proposal. This should be completed within two years following admission to the program. The research proposal, also called the thesis topic proposal, must be approved by the advisory committee. The research proposal demonstrates the student's knowledge of the relevant literature and the specific research problems and methods of study that, if successfully completed, will lead to an acceptable thesis.

Thesis Research (9 credit hours)
Each student in a program of study that includes a thesis option will complete a minimum of 9 credit hours of thesis research. The student must submit a written thesis for final review to the advisory committee three weeks before the defense date. The student must defend the thesis before the advisory committee at a presentation which is open to the University community. Upon approval of the written thesis and oral presentation by the advisory committee, the student has successfully completed the thesis requirement. The thesis must be written using a format acceptable to the Graduate School.

OPTI 6991 - Thesis Research (1 to 3)

Degree Total = 32 Credit Hours

Grade Requirements
Students in the M.S. program must maintain a minimum cumulative GPA of 3.0 in all coursework attempted for the degree. An accumulation of two C grades will result in suspension from the program. A grade of U earned in any course will result in suspension from the program. An accumulation of three C grades or two U grades will result in termination from the program.

Application for Degree
Students should submit an Application for Degree at the beginning of the term in which they anticipate graduating. Adherence to Graduate School deadlines is expected.

Assistantships
Support for beginning graduate students is usually a teaching assistantship. Continuing students are often supported by research assistantships.

Residency Requirement
The student must satisfy the residence requirement for the program by completing 12 credit hours of continuous enrollment in coursework/thesis credit. Residence is considered continuous if the student is enrolled in one or more courses in successive semesters until 12 credit hours are earned.

Transfer Credit
Up to 6 credit hours of approved coursework may be transferred from other a master's and/or doctoral program from a college or university accredited by an accepted accrediting body. Only courses in which the student earned a grade of B or above (or its equivalent) can be transferred. Credit for thesis research cannot be transferred.

ORGANIZATIONAL SCIENCE

- Ph.D. in Organizational Science

Graduate Program
orgscience.charlotte.edu

Ph.D. in Organizational Science

Organizational Science is an emerging interdisciplinary field of inquiry focusing on employee and organizational health, well-being, and effectiveness. Organizational Science is both a science and a practice. Enhanced understanding leads to applications and interventions that benefit the individual, work groups, the organization, the customer, the community, and the larger society in which the organization operates. Specific topics of study in Organizational Science include, but are not limited to: *Team Processes and Performance; Organizational Structure and Effectiveness; Selection, Testing, and Promotion; Leadership; Organizational Culture and Climate; Training and Development; Performance Evaluation; Workplace Health and Safety; Workplace Diversity; Employee Attitudes; Job Satisfaction and Turnover; Rewards and Recognition; Communication Effectiveness; Technology and Work; Employee Motivation and Participation; Employee Citizenship and Deviance; Work–Life Programs; Organizations and External Environment; Customer Service and Satisfaction; Organizational Behavior; Employee Recruitment and Socialization; Interorganizational Relations; and Organizational Change*. The discipline stems from (in alphabetical order): Human Resources Management, Industrial/Organizational Psychology, Organizational Behavior, Organizational Communication, Organizational Sociology, and Social Psychology.

Upon graduation, students will have achieved the following educational objectives:

- Acquire a comprehensive and integrated body of organizational science knowledge ranging from micro issues concerning employee selection and socialization to more macro issues concerning organizational structure and effectiveness
- Demonstrate competence in synthesizing and transcending disciplinary perspectives to generate novel, useful, and robust understandings of organizational science phenomena
- Demonstrate competence in planning, conducting, and evaluating Organizational Science research
- Demonstrate competence in teaching, communicating, and disseminating organizational science knowledge to others in an effective and pedagogically appropriate manner
- Demonstrate competence in collaborating with a diverse group of professionals, students, research participants, and consumers of organizational science services
- Demonstrate competence in applying research in organizational science to practice leading to applications and interventions that benefit the individual, the organization, the customer, and the larger community in which the organization operates

By meeting these objectives, graduates of the program will be prepared to assume leadership roles as organizational scholars, researchers, and educators in academic institutions and as practitioners and policy makers in a wide range of public and private settings. By doing so, our graduating doctoral students will be further promoting our core mission to advance employee and organizational health, well-being, and effectiveness.

Admission Requirements
In addition to the general requirements for admission to the Graduate School, we ask students to submit the following:

1) A one to two-page professional statement (discuss interest in the program and objectives for pursuing this degree)
2) A current resume or vita
3) International students (whose native language is not English) must submit official test scores on the Test of English as a Foreign Language (TOEFL) of at least 550 on the written test or 220 on the computer-based test or a score of at least 85% on the Michigan English Language Assessment Battery (MELAB). All tests must have been taken within the past two years

The following are recommended admissions requirements:

1) Completed undergraduate degree with a GPA of 3.0 or above
2) Completion of statistics and research methodology courses
3) Research experience

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Degree Requirements
Outlined below are the requirements of the Ph.D. in Organizational Science program. Additional detail on all can be found in the *Organizational Science Graduate Handbook*.

1) 77 credit hours (post baccalaureate) are required
2) Graduate students must have a 3.0 GPA in the courses on their degree plan of study in order to graduate. Two grades of C or one U will result in suspension from the program. If reinstated, another grade of C or U will result in termination from the program.
3) Students who have taken graduate coursework but have not earned graduate degrees may transfer in up to six credit hours of coursework. Students who have earned master's degrees may transfer up to thirty credit hours
4) Beyond the 30 hours that students with a Master's degree can transfer into the program, all coursework that will count toward the Ph.D. will be 6000-level or above. The majority of the coursework will be at the 8000 level
5) Master's thesis or Independent Pre-Doctoral Research Project is required
6) A qualifying exam is required. Failure to pass the qualifying examination after two attempts will result in termination from the program
7) A Dissertation is required
8) An organizational science practicum is optional
9) Each year, a student will have a performance appraisal assessment
10) A student may choose a disciplinary "emphasis" (e.g., an emphasis in Business, Sociology, Psychology, or Communication Studies). An emphasis includes three discipline-specific courses. A disciplinary emphasis would provide an opportunity for a student to combine interdisciplinary training with a core disciplinary specialization. Students preparing for careers in academia may benefit most from having such an emphasis. Students may choose to not have an "emphasis" and instead take electives that span across all disciplines. Program director approval is needed in order to count a course toward an emphasis
11) A student can consider co-enrolling in other MA programs at UNC Charlotte
12) Students must complete their degree, including dissertation, within nine years

Curriculum

The curriculum has three major curricular components: (1) Core Organizational Science and Research, (2) Electives/Advanced Seminars, and (3) Dissertation Research.

Core Organizational Science and Research Courses (41 credit hours)

OSCI 8000 - Organizational Science Overview (3)
OSCI 8001 - Current Topics and Events in Organizational Science (1) *(7 required; if OS Overview does not include a lab, 8 credit hours will be required)*
OSCI 8100 - Organizational Science Lab (1-2)
OSCI 8102 - Research Methodologies in Behavioral Sciences (3)
OSCI 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)
OSCI 8206 - Qualitative Research Methods (3)
OSCI 8208 - Advanced Qualitative Data Analysis (3)
OSCI 8610 - Micro Organizational Science I (3)
OSCI 8611 - Macro Organizational Science I (3)
OSCI 8620 - Micro Organizational Science II - (3)
OSCI 8621 - Macro Organizational Science II - (3)
OSCI 8948 - Independent Pre-Doctoral Organizational Science Research Project I (3)
OSCI 8949 - Independent Pre-Doctoral Organizational Science Research Project II (3)

Elective Courses (18 credit hours)

Select from the following:
OSCI 8002 - Ethics and Professional Issues in Organizational Science (2)
OSCI 8003 - Writing and Publishing in Organizational Science (1 to 3)
OSCI 8130 - Social Psychology (3)
OSCI 8207 - Psychometrics (3)
OSCI 8477 - Organizational Science Practicum (1 to 6) *(maximum of 3 credit hours unless approved by the Graduate Program Director)*
OSCI 8630 - Micro Seminar in Organizational Science (3) *(may be repeated up to 3 times)*
OSCI 8640 - Macro Seminar in Organizational Science (3) *(may be repeated up to 3 times)*
OSCI 8650 - Research Methods Seminar in Organizational Science (3) *(may be repeated up to 3 times)*

Other Elective Course Options

1) Graduate courses (6000 or 8000 level) in the Departments of Communication Studies, Psychological Science, Sociology, and the College of Business can serve as elective courses. Other content (e. g., strategy, decision making) or methods (e.g., multivariate, ethnography, focus group, SEM, categorical methods) courses outside of these core disciplines of OS can also serve as elective courses upon the approval of the Director (prior to taking the class). They must be at the 6000 or 8000 level.

2) OSCI 8899 - Organizational Science Readings and Research (1 to 3) *(there is no limit on the amount of readings and research credits a student can take)*
While 6 credit hours of readings and research will count for dissertation research, other credits of OSCI 8899 can be used for elective credits with the approval of the Director. But, this is only granted in limited circumstances and the student should never assume credits will be counted until they consult with the Director.

Dissertation Research (18 credit hours)

Required Dissertation Research Courses

OSCI 8998 - Organizational Science Dissertation I (6)

OSCI 8999 - Organizational Science Dissertation II (6)

Elective Dissertation Research Courses
Students may take additional credit hours of OSCI 8998 or OSCI 8999, or use up to 6 credit hours from OSCI 8899 to fulfill the remaining 6 credit hours of the 18 credit hour requirement for dissertation research.

OSCI 8998 - Organizational Science Dissertation I (6)
OSCI 8999 - Organizational Science Dissertation II (6)
OSCI 8899 - Organizational Science Readings and Research (1 to 3)

Degree Total = 77 Credit Hours

PHYSICS

- M.S. in Applied Physics
  - Applied Physics
  - Applied Optics

Department of Physics and Optical Science
physics.charlotte.edu

M.S. in Applied Physics

The Applied Physics degree program is excellent preparation for those planning to continue their education through the Ph.D., either in physics or an engineering field, or for a career as an instructor in a two-year college. Students electing the Thesis Option will be well qualified for employment in industry or in a research laboratory.

Students have opportunities for research in Biophysics, Computational Physics, Medical Physics, and Optics. The major research emphasis in the department is in the area of applied optics. The Department of Physics and Optical Science is the administrative coordinator of M.S. and Ph.D. programs in Optical Science and Engineering. These degree programs are interdisciplinary involving five science and engineering departments (Physics & Optical Science, Chemistry, Mathematics & Statistics, Electrical & Computer Engineering, and Mechanical Engineering & Engineering Science), the Center for Optoelectronics & Optical Communications, and the Center for Precision Metrology. A second area of emphasis is in biophysics, where there is a strong interdisciplinary relationship with the Ph.D. programs in Nanoscale Science, Biology, Bioinformatics and Computational Biology, and Applied Mathematics. The M.S. in Applied Physics program emphasizes basic and applied interdisciplinary education and research in many diverse areas that include:

- Statistical and computational physics
- Biological molecular motors
- Protein folding, stability, and dynamics
- Structural-based drug discovery
- Nuclear molecular resonance spectroscopy
- Micro-optics and nanophotonics
- Fiber and integrated optics
- Optoelectronic materials and devices
- Biomedical optics
- Optical interferometry and metrology
- Optical fabrication
- Nanoscale imaging and spectroscopy
- Adaptive optics
- Optical communication
- Novel light-matter interactions
- Quantum optics

- Optical sensors and measurements

A complete description of the programs and course offerings in Optical Science and Engineering can be accessed online at optics.charlotte.edu and under the "Optical Science and Engineering" heading in this section of the *Catalog*.

Admission Requirements

In addition to fulfilling the University's general requirements for graduate admission at the Master's level, applicants seeking admission into the M.S. in Applied Physics program must also:

1) Possess a Bachelor's degree in Physics, or a closely allied field, from a college or university accredited by an accepted accrediting body; applicants from fields other than Physics may expect to be required to remove deficiencies in their physics background
2) Present satisfactory scores on the GRE General Test (no subject test is required)
3) Possess an overall minimum GPA of 2.75 (based on a 4.0 scale) on all of the applicant's previous work beyond high school; the GPA in the major should be 3.0 or above
4) Present satisfactory scores on the Test of English as a Foreign Language, if the applicant is from a non-English speaking country
5) Demonstrate evidence of sufficient interest, ability, and preparation in physics to adequately profit from graduate study, as determined by the Physics Department's Graduate Committee

GRE Waiver

The GRE General Test requirement is waived for applicants who meet all other requirements and who are graduating from UNC Charlotte with a B.A. or B.S. degree in physics or who have graduated from UNC Charlotte with a B.A. or B.S. degree in physics within the past two years.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements

The M.S. in Applied Physics requires the completion of 30 credit hours approved by the Department of Physics and Optical Science. A minimum of 15 credit hours presented for the degree must be in courses numbered 6000 and above.

At the time of admission, up to 6 credit hours of graduate transfer credit may be accepted if approved by the Department of Physics and Optical Science and the Graduate School.

Students may, with departmental approval, apply up to 9 credit hours in non-cross-listed courses from graduate programs in related areas such as Bioinformatics, Biology, Chemistry, Engineering, Mathematics, and Nanoscale Science toward the 30 credit hour degree requirement.

All candidates for the degree must pass a final examination administered by their Advisory Committee.

Prerequisite Courses

Entering students not having the equivalent of PHYS 4222, PHYS 4232, or PHYS 4242 are required to take PHYS 5222, PHYS 5232, and/or PHYS 5242, as appropriate, before the end of their first year of residence. Courses for which undergraduate credit has been awarded may not be repeated for graduate credit.

Concentrations

There are two concentrations within the M.S. in Applied Physics program that include both thesis and non-thesis degree options:

1) Applied Physics Concentration *(Thesis or non-thesis option)*
2) Applied Optics Concentration *(Thesis option only)*

Thesis Option

The thesis defense is the final examination for students selecting the thesis option. Students selecting a concentration with a thesis option must present credit of at least 3 credit hours for each of the following courses:

PHYS 6991 - Physics Thesis Research I (3)
PHYS 6992 - Physics Thesis Research II (3)

Non-Thesis Option

Students selecting the non-thesis option must pass a final examination administered by their Advisory Committee. Example questions relating to subject matter for the examination are prepared by the Advisory Committee and

given to students at least 30 days prior to the examination date. Students prepare responses to these questions and make an oral presentation to members of the Committee that is based upon the prepared responses. Committee members may question students on any and all aspects of the relevant test material.

Degree Total = 30 Credit Hours

Grade Requirements
A minimum grade point average of 3.0 is required on all coursework attempted for the degree.

Admission to Candidacy
In addition to the general requirements for admission to candidacy, students enrolled in the Master of Science program in Applied Physics program should have:

1) Removed all identified entrance deficiencies by the time of application for admission to candidacy
2) Completed at least 18 approved credit hours with a GPA of 3.0 or above
3) Selected a major advisor and formed an advisory committee

Advisory Committee
Each student in the M.S. in Applied Physics Program must have a major advisor and an advisory committee. The student should select a major advisor before the end of the first year of residency. The student and the major advisor jointly determine the advisory committee. The advisory committee must have at least 3 members, the majority of which must be from the Department of Physics and Optical Science. The major advisor and the advisory committee must be in place prior to applying for degree candidacy.

Assistantships
Support for beginning graduate students is usually a teaching assistantship. Continuing students are often supported by research assistantships.

PSYCHOLOGY

- M.A. in Psychology
- M.A. in Industrial/Organizational Psychology

Department of Psychological Science
psych.charlotte.edu

M.A. in Psychology

The objective of the M.A. in Psychology program is to train psychologists in the knowledge and skills necessary to address problems encountered in modern living. The program provides a foundation in the research methods and content of basic psychology, as well as excellent preparation for doctoral programs in psychology. The relatively small, competitively selected student body receives individual attention from faculty members who maintain rigorous standards of academic excellence.

Note: Clinical training is not provided at the master's level. For clinical training at the doctoral level, please see the Ph.D. in Health Psychology program.

The M.A. program offers optional areas of emphasis: Community Psychology, Cognition, and Health Psychology (Health Psychology is available only for co-enrolled Ph.D. in Health Psychology students). Other focus areas can be considered with the backing of a faculty member. Applicants are encouraged to check with faculty in their area of interest to determine if they would be open to serving as their research advisors.

- For students interested in training in Community Psychology, read about community psychology and the award-winning program online at healthpsych.charlotte.edu/concentration-areas/community
- Information on Cognitive Science can be found online at cognisci.charlotte.edu

Applicants should check with faculty in those areas to determine if they would be open to serving as their research advisors. Without a faculty member who is willing to commit to serving as a research advisor for an applicant, the likelihood of being admitted to the program is very low.

Admission Requirements
Admission to the graduate program for Psychology is very competitive, with many students applying for the program. Students with the strongest qualifications are selected.

Application deadline for M.A. in Psychology is February 1. Late admit deadline is April 1. Please note: there are seldom positions available for students who submit late admit applications.

Students are admitted only for Fall semester. Application materials and instructions can be found on the Graduate Admissions website.

Undergraduate Work

- Minimum 3.0 GPA overall
- Minimum 3.0 GPA in psychology courses
- 18 credit hours of undergraduate psychology courses, including Introductory Psychology and Research Methods
- An undergraduate course in statistics

Additional Requirements

To be considered for admission, a student must present the following requirements in addition to those required by the Graduate School:

- Completed application by February 1
- An agreement with a member of the faculty in the Department of Psychological Science who will supervise the student's research

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are not required.

Degree Requirements

The program requires at least 30 credit hours of graduate coursework. Full-time students should be able to complete the program in two calendar years. All courses must be pre-approved by the student's advisory committee. Hours beyond the 30 credit hours may be required by the academic advisor and student's advisory committee.

During the first semester the student, with the agreement of the advisor (who must be a member of the Psychological Sciences faculty), must form a three-person advisory committee. At least one member of this committee must be on the faculty of the Department of Psychological Sciences. The members of the advisory committee may or may not be the same as members of the thesis committee.

The student, along with their committee, should draft a plan indicating which courses they anticipate taking, as well as a proposed sequence and a timeframe. Included should also be a timeframe to meet the milestones for the program (thesis proposal and defense), recognizing that some courses have prerequisites.

Students are expected to engage in research with their advisor throughout the program. A thesis is required.

Core Courses (18 credit hours)

Methodology Courses (6 credit hours)

Community Courses

PSYC 6145 - Applied Research Design and Program Evaluation (3)
PSYC 6205 - Field and Lab Based Quantitative Research Methods (3)
Courses in research methods approved by the student's advisory or thesis committee

Cognition Courses

OSCI 8650 - Research Methods Seminar in Organizational Science (3)
PSYC 6205 - Field and Lab Based Quantitative Research Methods (3)
PSYC 6650 - Research Methods Seminar in Organizational Science (3)
RSCH 6110 - Descriptive and Inferential Statistics (3)
RSCH 6120 - Advanced Statistics (3)
Courses in research methods approved by the student's advisory or thesis committee

Health Courses

These courses are available only for students currently enrolled in the Ph.D. in Health Psychology program.
HPSY 8102 - Research Design and Quantitative Methods in Psychology (3)
HPSY 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)

Ethics Courses (3 credit hours)

Select one of the following:

PSYC 6107 - Ethical and Professional Issues in Psychology (3)
HPSY 8107 - Ethical and Professional Issues in Psychology (3)
PHIL 6240 - Research Ethics in the Biological and Behavioral Sciences (3)
PHIL 8240 - Research Ethics in the Biological and Behavioral Sciences (3)

Specialty Area Courses (6 credit hours)

Community Courses

PSYC 6155 - Community Psychology (3)
PSYC 6355 - Community Research Practicum (3)
or PSYC 6455 - Practicum in Community Psychology (1 to 3)

Cognition Courses

Select two of the following:

PSYC 5316 - Cognitive Neuroscience (3)
PSYC 6111 - Psychology of Learning and Memory (3)
PSYC 6115 - Sensation and Perception (3)
PSYC 6116 - Cognition (3)

Health Courses
These courses are available only for students currently enrolled in the Ph.D. in Health Psychology program.
HPSY 8200 - Health Psychology I (3)
HPSY 8201 - Health Psychology II (3)

Thesis Course (1 to 3 credit hours)
PSYC 6999 - Thesis (1 to 3)

Thesis committees shall have at least 3 members. At least one member should be a member of the psychology faculty. The committee must be approved by the student's advisor and the program director. After submitting the formal written proposal to the committee, a proposal defense will be scheduled. Approval of the thesis proposal by the committee must be unanimous. Following a successful proposal, the student shall execute the study, write and submit the complete thesis to the committee. An oral defense in front of the committee shall then be scheduled. Approval of the completed thesis by the committee must be unanimous.

Elective Courses (12 credit hours)
A minimum of 12 elective credit hours selected in consultation with the student's advisory committee is required. Available elective courses include all Psychology (PSYC) graduate courses and the following courses from other departments:

COMM 6000 - Topics in Communication Studies (3)
COMM 6130 - Rhetorical Criticism (3)
ENGL 5167 - The Mind and Language (3)
ENGL 6161 - Introduction to Linguistics (3)
ENGL 6163 - Understanding Language Learning: Mind, Identity, and the Sociocultural World (3)
GEOG 5110 - Geographic Information Systems for Non-Majors (3)
GEOG 6005 - Topics in Earth and Environmental Systems (3)
GRNT 6210 - Aging and Public Policy (3)
GRNT 6600 - Current Issues in the Diverse Experiences of Aging (3)
HLTH 6202 - Community Epidemiology (3)
HLTH 6220 - Applied Health Behavior Change (3)
HLTH 6227 - Community Health Planning and Evaluation (3)
HLTH 6228 - Social Determinants of Health (3)
HSRD 8000 - Topics in Health Services Research (1 to 4)
HSRD 8202 - Healthcare Systems and Delivery (3)
HSRD 8203 - Economics of Health and Healthcare (3)
ITCS 6050 - Topics in Intelligent Systems (3)
ITCS 6150 - Intelligent Systems (3)
ITIS 6400 - Human-Centered Design (3)
KNES 5232 - Physiology of Human Aging (3)
KNES 6285 - Advanced Cardiopulmonary Physiology (3)
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6210 - Aging and Public Policy (3)
MPAD 6311 - Introduction to Nonprofit Management (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
NURS 6115 - Health Policy and Planning in the U.S. (3)
OSCI 8650 - Research Methods Seminar in Organizational Science (3)
PHIL 6050 - Topics in Philosophy (1 to 3)
PHIL 6240 - Research Ethics in the Biological and Behavioral Sciences (3)
PHIL 6340 - Philosophy of Mind (3)
PHIL 8240 - Research Ethics in the Biological and Behavioral Sciences (3)
PPOL 8661 - Social Organization of Healthcare (3)
PPOL 8663 - Health Policy (3)
PPOL 8667 - Economic of Health and Healthcare (3)

Degree Total = 30 Credit Hours

Grade Requirements
Hours beyond the required 30 credit hours of graduate course work may be required by the academic advisor and the student's advisory committee. The faculty conduct a thorough review of student performance on a regular basis. Continuation in the program is contingent upon a favorable review during these evaluations. Students who consistently show borderline course performance, who fail to complete coursework in a timely basis, or who otherwise perform unprofessionally or unsatisfactorily, may be required to complete additional courses or may be removed from the program. The enrollment of a student who receives three grades of C or one Unsatisfactory (U) grade during his or her graduate career is automatically terminated.

Assistantships
A variety of resources are available for financial assistance. These include teaching assistantships, research assistantships from faculty grants, and graduate assistantships in other campus units such as the Learning Center and Disability Student Services.

Research Experiences
Students are required to become involved in ongoing research in the department, and they are required to complete a thesis.

M.A. in Industrial/Organizational Psychology

The objective of UNC Charlotte's nationally recognized master's degree program in Industrial/Organizational (I/O) Psychology is to provide students with the knowledge and skills necessary to improve the world of work from both an employee and organizational point of view. The

program and its curriculum are built on five key foundational elements: Leadership, Organizational Change and Development, Talent, Culture/Climate, and Analytics. The program provides these foundations in the context of science-driven practice. Specifically, students are provided with a strong foundation in (a) reading, understanding and applying the science of I/O Psychology to solve organizational problems and (b) collecting, critically evaluating, and statistically examining data to support organizational decision-making. Students receive individual attention from faculty members who maintain rigorous standards of academic excellence.

The program is designed to be accessible for working professionals. Courses are offered in the evenings and on weekends so that individuals who work full-time can complete the program. The program is ideal for people working in an I/O-related field, such as in a Human Resources function within an organization, who are looking for a degree that will allow them to expand their career options. The program is also appropriate for working individuals looking to change careers and for individuals who have just completed an undergraduate degree. Work in an I/O-related career is not required for admittance into the program.

An Advisory Board has been established for the I/O Program. The Board, made up of leading I/O psychologists and human resource professionals working in the Charlotte Community (see the department website for a list of current Board members), provides regular reviews and evaluations of the programs' curriculum to ensure that course content addresses current topics and issues facing I/O psychologists working in the business community. The Board also plays a key role in identifying business leaders in the community who can provide information or guidance to students.

Admission Requirements

- **Test Scores -** Submit scores from the Graduate Record Exam (GRE), Graduate Management Admission Test (GMAT), or Miller Analogies Test (MAT). The I/O program will accept scores from any one of these tests.
- **Letters of Recommendation -** Two letters of recommendation from working professionals who received a bachelor's degree more than five years ago are suggested to seek out recommenders who can speak to their capabilities and potential as an I/O or HR professional (e.g., supervisors, coworkers, individuals with an advanced I/O degree). Applicants who have recently graduated from a bachelor's program, should seek out academic recommenders who can speak to their potential for graduate studies.
- **Statement of Purpose** - Minimally, the statement should address: (a) motivation for seeking a degree in I/O psychology, (b) preparation for graduate studies in I/O Psychology, and (c) expectation of how the degree will positively impact your career. Statements should be kept to approximately two pages.
- **Degree -** Applicants must also have a bachelor's degree from a college or university accredited by an accepted accrediting body (the Graduate School requires that applicants upload transcripts from each institution attended). While a degree in psychology or business is not required, applicants with backgrounds in these disciplines may be given preferential treatment.
- **Additional Requirements -** The Graduate School has additional requirements for applications. Please see The Graduate School section and/or the website at graduateschool.charlotte.edu for additional details.

Admission to the program is competitive. Applicants whose native language is other than English must offer acceptable scores on the Test of English as a Foreign Language (see graduateschool.charlotte.edu for what constitutes an acceptable score). Applications should be submitted by February 1 of years that applications are accepted (applications are accepted on an every other year basis).

Degree Requirements

A minimum of 31 credit hours of graduate coursework is required. Courses will be required during the Summer Session between the first and second year in the program. Additional details about these requirements can be found in the *I/O Psychology Graduate Student Handbook*.

Core Courses (30 credit hours)

PSYC 6102 - Organizational Research Methods (3)
or OSCI 8102 - Research Methodologies in Behavioral Sciences (3)
PSYC 6171 - Industrial/Organizational Psychology (3)
or OSCI 8000 - Organizational Science Overview (3)
PSYC 6172 - Talent Acquisition (3)
or OSCI 8610 - Micro Organizational Science I (3)
PSYC 6173 - Job Attitudes (3)
or OSCI 8611 - Macro Organizational Science I (3)
PSYC 6175 - Organizational Development and Change (3)
or OSCI 8621 - Macro Organizational Science II (3)
PSYC 6177 - Talent Management (3)
or OSCI 8620 - Micro Organizational Science II (3)
PSYC 6205 - Field and Lab Based Quantitative Research Methods (3)
or OSCI 8103 - Basic Quantitative Analyses for Behavioral Sciences (3)
PSYC 6207 - Measurement in Organizations (3)
or OSCI 8630 - Micro Seminar in Organizational Science (3)
PSYC 6630 - Topics in Talent Management (3)
or OSCI 8206 - Qualitative Research Methods (3)

PSYC 6640 - Topics in Organizational Psychology (3)
or OSCI 8640 - Macro Seminar in Organizational Science (3)

Specialization Tracks (1 or 6 credit hours)

Students select a specialization track: (1) a thesis research track or (2) a practice track. These tracks allow the student to tailor, in part, their educational experience to their career objectives. The only difference between the tracks is the capstone experience. A complete description of the specialization tracks and requirements (including a thorough discussion of the comprehensive exam) can be found in the most recent version of the *I/O Psychology Graduate Student Handbook*.

Thesis Research Track Option (6 credit hours)

Students choosing the thesis track defend an empirical thesis and take the following:

PSYC 6999 - Thesis (1 to 3) *(taken for 6 credit hours if completing the empirical thesis)*

OR

OSCI 8948 - Independent Pre-Doctoral Organizational Science Research Project I (3)
and OSCI 8949 - Independent Pre-Doctoral Organizational Science Research Project II (3)

Practice Track Option (1 credit hour)

Students choosing the practice track complete a standardized comprehensive examination in the summer of year two in the program and take the following course. The examination samples content from across the I/O Psychology discipline.

PSYC 6899 - Readings and Research in Psychology (1 to 4) *(taken for 1 credit hour if taking the comprehensive exam)*

Additional Requirements

All PSYC courses in the Industrial/Organizational Psychology curriculum may be taken only with permission of the Department of Psychological Science or course instructor. Access to registration for these courses is only by permission of the Department of Psychological Science or course instructor.

Students enrolled in both the M.A. in Industrial/ Organizational Psychology program and the Ph.D. in Organizational Science program must meet additional requirements. If the student chooses a thesis chair who is not an I/O Psychology faculty member or I/O program affiliated faculty member as listed on the website, the student must complete an extra requirement to demonstrate mastery and socialization as an I/O psychologist. This can be achieved in one of two ways.

1) The student may take the I/O Psychology M.A. comprehensive exam (to be administered by an I/O program faculty member)

OR

2) The student may take 2 or more credit hours of practicum. The practicum content must be approved by the I/O M.A. Graduate Program Director. Practicum credit hours do not count toward the required credit hours for the I/O program, but may be used as elective credit hours towards the Ph.D. in Organizational Science program.

   OSCI 8477 - Organizational Science Practicum (1 to 6)

Degree Total = 31-36 Credit Hours

Grade Requirements

Students who receive two grades of C or one Unsatisfactory (U) grade during their graduate career are automatically terminated from the program.

Students must complete either a comprehensive examination or orally defend a thesis project. Failure to pass the qualifying exam or the oral defense after two attempts will result in termination from the program.

Practica and Applied Experiences

Students who desire I/O-related work experiences have a wide range of opportunities for applied experiences. These can occur as part of a formal practicum experience (i.e., internships) or more informally through the UNC Charlotte Organizational Science Consulting and Research Unit. While practicum experiences are not required as part of the program, Faculty and Advisory Board members have connections within the local community to help students find relevant experiences.

PUBLIC ADMINISTRATION

- The Gerald G. Fox Master of Public Administration (MPA)
  - Arts Administration
  - Emergency Management
  - Nonprofit Management
  - Public Finance
  - Urban Management and Policy
- Graduate Certificate in Emergency Management
- Graduate Certificate in Nonprofit Management
- Graduate Certificate in Public Budgeting and Finance
- Graduate Certificate in Urban Management and Policy

Department of Political Science and Public Administration

mpa.charlotte.edu

Master of Public Administration (MPA)

The primary objective of the Gerald G. Fox Master of Public Administration (MPA) degree program is to provide professional training in public administration. The curriculum of this National Association of Schools of Public Affairs and Administration (NASPAA) accredited program emphasizes the analysis of the political and administrative environments as well as the administrative decision-making approaches of public administration. Application of techniques and administrative skills to the management of nonprofit organizations is also included in the curriculum. The methods of instruction employed in the program expose students to a variety of approaches to public management.

Students may enroll in the Master of Public Administration program on either a full-time or part-time basis. The majority of classes are scheduled in the evening throughout the year. Classes meet on the main University campus and at UNC Charlotte Center City.

Admission Requirements

Admission to the Master of Public Administration program is open to qualified graduates of a college or university accredited by an accepted accrediting body. There are seven major requirements for admission:

1) Application submitted online to the Graduate Admissions Office, accompanied by the application fee, which is neither deductible nor refundable
2) Possession of a bachelor's degree, or its equivalent, from a college or university accredited by an accepted accrediting body
3) An undergraduate grade point average of at least 3.0 on a 4.0 scale
4) An appropriate score on the Verbal, Quantitative, and Analytical portions of the Graduate Record Exam (GRE). Although there is no required score for these exams, typically an acceptable score would be above the 35th percentile.
5) A written statement of professional career goals and a description of any significant work experience, particularly in the public or nonprofit sectors
6) Three supporting letters of recommendation from professors or employers
7) Submission of two official transcripts from all postsecondary educational institutions in which the candidate was enrolled

GRE Waiver

A GRE waiver will be issued if a student has a minimum undergraduate cumulative GPA of 3.5. A GRE waiver will also be issued if a student has five or more years' work experience in the public or nonprofit sector and has taken two courses in the program and received grades of B or above, and completed STAT 1222 (Elementary Statistics for the Social Sciences) or its equivalent with a grade of C or above.

Prerequisite Requirements

In addition to the admission requirements, MPA students must:

- Complete STAT 1222 (Elementary Statistics for the Social Sciences) or its equivalent with a grade of C or above
- Complete, POLS 1110 (Introduction to American Government) or its equivalent with a grade of C or above must be completed prior to taking MPAD 6102
- Demonstrate proficiency in computer applications (e.g., ability to use Microsoft Word, Excel, and PowerPoint) prior to taking MPAD 6126

Students may complete these after admission into the program.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The Master of Public Administration program is structured in three distinct phases: 1) Core, 2) Advanced Work, and 3) directed Study Or Research Project. In all, the program requires 39 hours of graduate credit for completion of the degree. The *MPA Program Handbook*, available online at mpa.charlotte.edu, presents the most up-to-date listing of degree requirements.

Core Courses (18 credit hours)

All students are required to complete 18 credit hours in core study. The emphasis in the core is twofold: (a) Understanding the various managerial and analytical approaches salient to the environment of public administration, and (b) Achieving an overall perspective on the problems of public administration. Students must attain a grade of B or above in each core course prior to enrolling in MPAD 6187 and MPAD 6188. Students earning grades of C in a core course must retake that course at the earliest possible opportunity. The core courses are:

MPAD 6102 Foundations in Public Administration (3)
MPAD 6104 Public Organizations and Management (3)
MPAD 6125 Quantitative Research Methods in Public Administration (3)
MPAD 6126 Data Analysis for Decision Making (3)
MPAD 6131 Public Budgeting and Finance (3)
MPAD 6134 Human Resources Management (3)

Advanced Courses

Elective Courses (12-15 credit hours)

The MPA program offers several advanced elective courses in areas important to public administrators. With the approval of the program director, students may take advanced elective work with other departments. Students are required to take a minimum of fifteen hours of advanced electives unless they opt for the Directed Study option (see below), in which case they need only take twelve hours of advanced electives. The MPA electives are:

MPAD 6000 - Topics for Graduate Study in Public Administration (1 to 4)
MPAD 6128 - Foundations of Public Policy Analysis
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6143 - Introduction to Administrative Law (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6172 - Administration of Healthcare Systems in the U.S. (3)
MPAD 6174 - Public Policy and Politics in Healthcare Administration (3)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6185 - Intergovernmental Relations (3)
MPAD 6210 - Aging and Public Policy (3)
MPAD 6211 - Administration of Aging Programs (3)
MPAD 6290 - Emergency Management (3)
MPAD 6291 - Homeland Security and Terrorism (3)
MPAD 6292 - Disaster Management (3)
MPAD 6310 - Foundations of the Nonprofit Sector (3)
MPAD 6311 - Intro to Nonprofit Management (3)
MPAD 6312 - Fundraising (3)
MPAD 6314 - Marketing for Arts and Nonprofit Organizations (3)
MPAD 6316 - Introduction to Arts Administrations (3)
MPAD 6318 - Arts Administration II (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6326 - Applied Economics for Public Administrators (3)
MPAD 6327 - Internal Capacity Building in Nonprofit Organizations (3)
MPAD 6328 - Urban and Community Development (3)
MPAD 6329 - Nonprofit Organizations and their Environment (3)
MPAD 6330 - Program Evaluation for the Public & Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
MPAD 6350 - Public Sector Financial Management (3)
MPAD 6352 - Public Sector Financial Reporting and Analysis (3)
MPAD 6820 - Independent Study (1 to 3)

Capstone Seminar (3 credit hours)

Students are required to complete the capstone course. Students must successfully complete all of their Core Courses with a grade of B or above prior to enrolling in this course.

MPAD 6187 - Advanced Seminar in Public Management Problem Solving (3)

Directed Study or Research Applications Courses

Each MPA student must complete one of the options (A or B). Students must successfully complete all of their Core Courses with a grade of B or above prior to enrolling in any courses listed in this section.

Research Applications Course

Students who select this option complete a one-semester written project course on an approved topic of significance in public administration or nonprofit management. The project includes the submission of revised paper drafts based on instructor evaluation.

Students must enroll in the following course, which is graded A, B, C, or U:

MPAD 6188 - Research Applications in Public Administration (3)

Directed Study Courses

Students who select this option complete a written project on a topic of significance based on a field experience or research in public administration, nonprofit management, or arts administration. The Directed Study requires the following courses, graded on a pass/unsatisfactory basis:

MPAD 6800 - Directed Study in Public Administration (Proposal) (3)
MPAD 6801 - Directed Study in Public Administration (Completed Study) (3)

University regulations governing the preparation and submission of Master's theses apply to the Directed Study option. Rules for the Directed Study committee are provided in the *MPA Program Handbook*. Students who select option B may take one less elective course for 3 credit hours to complete the MPA degree in the required 39 credit hours.

Degree Concentrations

Students complete one of five approved 15 credit hour concentrations or they may develop their own program of study from elective courses. Students who choose a concentration must focus their research in MPAD 6188, or MPAD 6800 and MPAD 6801 on an approved topic related to the concentration subject matter.

Arts Administration Concentration

Prerequisite(s): For students with an undergraduate degree not in the arts: You are required to take no less than four 3-credit hour undergraduate arts courses (or the equivalent) in order to develop the necessary foundation of appreciation for the arts required of arts administrators. The exact set of courses is determined by the field of arts on which you desire to focus and in consultation with your advisor. The prerequisites vary by visual arts, dance, theater, and music. Ideally, these prerequisites are completed prior to admission into the MPA program. However, students who opt for the arts administration concentration after being admitted to the MPA program will have to complete these prerequisites prior to admission into MPAD 6187, MPAD 6188, or MPAD 6316. Substantive professional experience in the arts field can be used as a substitute or partial substitute (e.g., students may be required to take less than 4 arts courses) for the undergraduate prerequisites at the discretion of the MPA Program Director.

The Concentration in Arts Administration consists of 15 credit hours within the MPA curriculum. Students must fulfill the following requirements:

Required Courses (6 credit hours)

MPAD 6311 - Introduction to Nonprofit Management (3)
MPAD 6316 - Introduction to Arts Administration (3)

Elective Courses (9 credit hours)

Group A

Select one of the following:

MPAD 6312 - Fundraising (3)
MPAD 6314 - Marketing for Arts and Nonprofit Organizations (3)

Group B

Select one of the following:

MPAD 6128 - Foundations of Public Policy (3)
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6327 - Internal Capacity Building in Nonprofit Organizations (3)
MPAD 6329 - Nonprofit Organizations and their Environment (3)
MPAD 6318 - Arts Administration II (3)
COMM 6145 - Communication Campaign Management (3)
COMM 6146 - Media Relations (3)
HIST 6310 - Museum Studies (3)
ANTH 5120 - Intercultural Communications (3)
ENGL 5182 - Information Design and Digital Publishing (3)

Group C

Select one of the following:

MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Emergency Management Concentration

The Concentration in Emergency Management concentration consists of 15 credit hours within the MPA curriculum. Students must fulfill the following requirements:

Required Courses (6 credit hours)

MPAD 6290 - Emergency Management (3)
MPAD 6185 - Intergovernmental Relations

Elective Courses (9 credit hours)

Group A

Select one of the following:

MPAD 6142 - Grant Writing and Reporting (3)

MPAD 6291 - Homeland Security and Terrorism (3)
MPAD 6292 - Disaster Management (3)
GEOG 5110 - Geographic Information Systems for Non-Majors (3)
GEOG 5120 - Introduction to Geographic Information Systems (3)

Group B
Select one of the following:
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6143 - Administrative Law (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
GEOG 5130 - Advanced Geographic Information Systems (3)
CJUS 5103 - International Criminal Justice (3)
CJUS 6120 - Criminal Justice Management and Decision Making (3)
CJUS 6132 - Legal Issues in Law Enforcement
COMM 6120 - Communication and the Network Society (3)
PSYC 6155 - Community Psychology (3)
ITIS 5250 - Computer Forensics (3)
CSLG 7680 - Crisis Counseling (3)

Group C
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Nonprofit Management Concentration
The Concentration in Nonprofit Management consists of 15 credit hours within the MPA curriculum. Students must fulfill the following requirements:

Required Courses (6 credit hours)
MPAD 6311 - Introduction to Nonprofit Management (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)

Elective Courses (9 credit hours)
Group A
Select two of the following:
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6310 - Foundations of the Nonprofit Sector (3)
MPAD 6312 - Fundraising (3)
MPAD 6314 - Marketing for Arts and Nonprofit Organizations (3)
MPAD 6316 - Introduction to Arts Administration (3)
MPAD 6318 - Arts Administration II (3)
MPAD 6327 - Internal Capacity Building in Nonprofit Organizations (3)
MPAD 6329 - Nonprofit Organizations and their Environment (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)

Group B
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Public Budgeting and Financial Management Concentration
The Concentration in Public Budgeting and Financial Management consists of 15 credit hours within the MPA curriculum. Students must fulfill the following requirements:

Required Courses (6 credit hours)
MPAD 6326 - Applied Economics for Public Administrators (3)
MPAD 6350 - Public Sector Financial Management (3)

Elective Courses (9 credit hours)
Select three of the following:
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6185 - Intergovernmental Relations (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
MPAD 6352 - Public Sector Financial Reporting and Analysis (3)
ECON 6112 - Graduate Econometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)
MBAD 6159 - Real Estate Development (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Urban Management and Policy Concentration
The Concentration in Urban Management and Policy consists of 15 credit hours within the MPA curriculum. Students must fulfill the following requirements:

Required Courses (6 credit hours)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6185 - Intergovernmental Relations (3)

Elective Courses (9 credit hours)
Group A
Select two of the following:
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6143 - Introduction to Administrative Law (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6290 - Introduction to Emergency Management (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6326 - Applied Economics for Public Administrators (3)
MPAD 6328 - Urban and Community Development (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
MPAD 6350 - Public Sector Financial Management (3)
MPAD 6352 - Public Sector Financial Reporting and Analysis (3)
GEOG 5155 - Retail Location (3)
GEOG 5110 - Geographic Information Systems for Non-Majors (3)
or GEOG 5120 - Introduction to Geographic Information Systems (3)
GEOG 5210 - Urban Planning Methods (3)
GEOG 5260 - Transportation Policy Formulation (3)
GEOG 6300 - Applied Regional Analysis (3)
GEOG 6301 - Industrial Location (3)
GEOG 6500 - Urban Planning: Theory and Practice (3)

Group B
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Degree Total = 39 Credit Hours

Advising
Each student is assigned an advisor and given access to the *MPA Program Handbook* when admitted to the program. The advisor is a member of the MPA Program faculty. Students should meet with their advisors each semester to develop a schedule before registering. Students are also encouraged to meet with the Program Director for additional advising when necessary.

Internships
Each student in the Master of Public Administration Program is required to complete a field experience. This requirement may be satisfied in one of these ways: (1) through a position in a public or nonprofit organization; (2) through a position in a business where the work experience is approved for internship by the MPA director; or (3) through an approved internship in a public or nonprofit organization. Each student must complete an "MPA Internship Information" form and submit it to the MPA Program office for approval. Forms to evaluate the internship experience must also be completed. These forms are available in the main MPA office. Current guidelines for the internship requirement are provided in the *MPA Program Handbook.*

Public Service Fellowships
The department works with local area government and nonprofit agencies to provide fellowships to students on a competitive basis. Host agencies employ fellows on a part-time basis (20 hours per week) for a period of one to two years. In exchange for their services, agencies pay fellows a small stipend and tuition expenses for Fall and Spring semesters.

Scholarships
1) The North Carolina City and County Management Association funds a scholarship for an MPA student to help train students for careers in North Carolina local government. The MPA Program selection committee nominates the eligible recipient each fall.
2) Burkhalter-Rassel Alumni Scholarship - the MPA Alumni Association has established a scholarship fund to honor a former Charlotte City Manager.
3) Brown-Dorton MPA Scholarship - the MPA selection committee nominates eligible recipients each fall.
4) Susan Burgess Scholarship – the MPA selection committee nominates eligible recipients
5) Gerald G. Fox Scholarship – the MPA selection committee nominates eligible recipients
6) Other awards are available on a competitive basis through the Graduate School.
7) Other professional associations occasionally offer scholarships for which MPA students have competed successfully.

Transfer Credit
Up to six credit hours taken at another university can be transferred to the MPA Program on the recommendation of the Director and the approval of the Dean of the Graduate School.

Graduate Certificate in Emergency Management

The Graduate Certificate in Emergency Management is designed to provide graduate education in emergency management to those individuals who are currently serving as managers in public, nonprofit, and private organizations, or those who might want to pursue a career in emergency management. The certificate is also intended to serve the interests of students enrolled in UNC Charlotte graduate programs currently. Topics of study include, but are not limited to, homeland security and terrorism, emergency prevention and response, and disaster management. The focus of the certificate is to provide the knowledge and skills necessary to manage emergency programs in the most effective, efficient, and legally sound manner.

Admission Requirements

Admission to the Graduate Certificate program in Emergency Management is open to graduates of a college or university accredited by an accepted accrediting body. To apply, the student must meet the following requirements:

1) A completed Graduate Admissions application form and statement of professional goals
2) 12 months of full-time continuous employment in a government agency, nonprofit organization, or appropriate business organization (or be currently enrolled in another graduate program). This requirement may be waived for students who already have a Master's degree.
3) Two official transcripts from post-secondary educational institutions
4) Three letters of recommendation from academic or professional sources
5) An overall GPA of 2.75 on a 4.0 scale

Certificate Requirements

The Graduate Certificate Program in Emergency Management requires 15 credit hours.

Core Courses (6 credit hours)

MPAD 6290 - Emergency Management (3)
MPAD 6185 - Intergovernmental Relations (3)

Elective Courses (9 credit hours)

Group A
Select one of the following:
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6291 - Homeland Security and Terrorism (3)
MPAD 6292 - Introduction to Disaster Management (3)
GEOG 5190 - Geographic Information Systems for Non-Majors (3)

Group B
Select one of the following:
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6143 - Administrative Law (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
CJUS 5103 - International Criminal Justice (3)
CJUS 6120 - Criminal Justice Management and Decision Making (3)
CJUS 6132 - Legal Issues in Law Enforcement (3)
COMM 6120 - Communication and the Network Society (3)
CSLG 7680 - Crisis Counseling (3)
GEOG 5130 Advanced Geographic Information Systems (3)
ITIS 5250 - Computer Forensics (3)
PSYC 6155 - Community Psychology (3)

Group C
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Certificate Total = 15 Credit Hours

Transfer Credit

No more than three credit hours may be transferred into the certificate program from other academic institutions.

Graduate Certificate in Nonprofit Management

The Graduate Certificate in Nonprofit Management is designed to provide graduate education in nonprofit management for those individuals who are currently serving as managers or volunteers in nonprofit organizations, or those who might want to pursue careers in nonprofit management. The certificate is also intended to serve the interests of students currently enrolled in UNC Charlotte graduate programs.

Admission Requirements

Admission to the Graduate Certificate program in Nonprofit Management is open to graduates of a college or university accredited by an accepted accrediting body. To apply, the student must meet the following requirements:

1) A completed Graduate Admissions application form and statement of professional goals
2) 12 months of full-time continuous employment in a government agency, nonprofit organization, or appropriate business organization (or be currently enrolled in another graduate program). This requirement may be waived for students who already have a Master's degree.
3) Two official transcripts from post-secondary educational institutions
4) Three letters of recommendation from academic or professional sources
5) An overall GPA of 3.0 on a 4.0 scale

Certificate Requirements

The Graduate Certificate in Nonprofit Management consists of 15 credit hours within the MPA curriculum.

Core Courses (6 credit hours)

MPAD 6311 - Introduction to Nonprofit Management (3)
MPAD 6324 - Financial Analysis for Government and Nonprofit Organizations (3)

Elective Courses (9 credit hours)

Group A
Select two of the following:
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6310 - Foundations of the Nonprofit Sector (3)
MPAD 6312 - Fundraising (3)
MPAD 6314 - Marketing for the Arts and Nonprofit Organizations (3)
MPAD 6316 - Introduction to Arts Administration (3)
MPAD 6318 - Arts Administration II (3)
MPAD 6327 - Internal Capacity Building in Nonprofit Organizations (3)
MPAD 6329 - Nonprofit Organizations and the Environment (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)

Group B
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Certificate Total = 15 Credit Hours

Transfer Credit

No more than three credit hours may be transferred into the certificate program from other academic institutions.

Graduate Certificate in Public Budget and Finance

The Graduate Certificate in Public Budget and Finance is designed to provide graduate education in public finance to managers in public sector organizations.

Admission Requirements

Admission to the Graduate Certificate in Public Budget and Finance program is open to graduates of a college or university accredited by an accepted accrediting body. To apply, students must meet the following requirements:

1) A completed Graduate Admissions application form and statement of professional goals
2) Official transcripts from all post-secondary educational institutions
3) Three letters of recommendation from academic or professional sources
4) An overall GPA of 3.0 on a 4.0 scale

Certificate Requirements

The Graduate Certificate in Public Budget and Finance consists of 15 credit hours within the MPA curriculum.

Required Courses (9 credit hours)

MPAD 6131 - Public Budgeting and Finance (3)
MPAD 6326 - Applied Economics for Public Administrators (3)
MPAD 6350 - Public Sector Financial Management (3)

Elective Courses (6 credit hours)

Select two of the following:
MPAD 6142 - Grant Writing and Reporting (3)
MBAD 6159 - Real Estate Development (3)
MPAD 6185 - Intergovernmental Relations (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Program Planning (3)
MPAD 6352 - Public Sector Financial Reporting and Analysis (3)
ECON 6112 - Graduate Econometrics (3)
ECON 6218 - Advanced Business and Economic Forecasting (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Certificate Total = 15 Credit Hours

Transfer Credit
No more than three credit hours may be transferred into the certificate program from other academic institutions.

Graduate Certificate in Urban Management and Policy

The Graduate Certificate in Urban Management and Policy is designed to provide graduate education in urban local government to individuals who are currently serving as managers in public organizations in the Charlotte Region, or those who might want to pursue a career in local government management.

Admission Requirements
Admission to the Graduate Certificate program in Urban Management and Policy is open to graduates of a college or university accredited by an accepted accrediting body. To apply, the student must meet the following requirements:

1) A completed Graduate Admissions application form and statement of professional goals.
2) Official transcripts from all post-secondary educational institutions.
3) Three letters of recommendation from academic or professional sources.
4) An overall GPA of 3.0 on a 4.0 scale. The GPA will be weighed less heavily for students who have at least 3 years of experience working in the public or nonprofit sectors after graduating from their undergraduate programs.

Certificate Requirements
The Graduate Certificate in Urban Management and Policy consists of 15 credit hours within the MPA curriculum.

Required Courses (6 credit hours)
MPAD 6184 - Urban Government and Politics (3)
MPAD 6185 - Intergovernmental Relations (3)

Elective Courses (9 credit hours)
Group A
Select two of the following:
MPAD 6128 - Foundations of Public Policy (3)
MPAD 6142 - Grant Writing and Reporting (3)
MPAD 6143 - Introduction to Administrative Law (3)
MPAD 6160 - Leadership in the Digital Era (3)
MPAD 6290 - Introduction to Emergency Management (3)
MPAD 6324 - Financial Analysis for Nonprofit Organizations (3)
MPAD 6326 - Applied Economics for Public Administrators (3)
MPAD 6328 - Urban and Community Development (3)
MPAD 6330 - Program Evaluation for the Public and Nonprofit Sectors (3)
MPAD 6332 - Project Management (3)
MPAD 6350 - Public Sector Financial Management (3)
MPAD 6352 - Public Sector Financial Reporting and Analysis (3)
GEOG 5155 - Retail Location (3)
GEOG 5110 - Geographic Information Systems for Non-Majors (3)
or GEOG 5120 - Introduction to Geographic Information Systems (3)
GEOG 5210 - Urban Planning Methods (3)
GEOG 5260 - Transportation Policy Formulation (3)
GEOG 6300 - Applied Regional Analysis (3)
GEOG 6301 - Industrial Location (3)
GEOG 6500 - Urban Planning: Theory and Practice (3)

Group B
Select one of the following:
MPAD 5xxx - Public Administration Elective (3)
MPAD 6xxx - Public Administration Elective (3)

Note: Appropriate non-MPAD courses may be taken within this concentration upon approval of the student's advisor and the MPA Director.

Certificate Total = 15 Credit Hours

Transfer Credit
No more than three credit hours may be transferred into the certificate program from other academic institutions.

PUBLIC POLICY

- Ph.D. in Public Policy
  - Economic Policy
  - Environmental/Infrastructure Policy
  - Health Policy
  - Justice Policy
  - Social Policy
  - Urban and Regional Development Policy
- Graduate Certificate in Public Policy Research and Analysis

Graduate Program
publicpolicy.charlotte.edu

Ph.D. in Public Policy

The Ph.D. in Public Policy is an interdisciplinary program focused on the study of policy development, implementation, and evaluation. It stresses the development of skills, tools, and specialties, as well as a theoretical understanding of them, that contribute to our understanding of the structure of institutional systems and sub-systems, and of how policy should be shaped within social, economic, and political environments.

The Ph.D. in Public Policy degree program prepares students to be researchers, decision makers, and policy analysts in local, state, or federal governments, not-for-profit agencies, for-profit institutions, and academia. The program stresses applied and empirical policy research grounded in an interdisciplinary theoretical foundation. The intellectual focus of the program is guided by four overarching themes:

1) Interdisciplinary Perspective: Effective policy analysis and policy formation are not informed by any single discipline. Rather, public policy requires knowledge of the historical, cultural, political, institutional, geographic, and economic dimensions of policy problems facing any community.
2) Applied and Empirical Policy Analysis: Public policy is an inherently applied endeavor that seeks practical solutions and cogent analysis. While theory informs all research and analysis, the purpose of policy research is to elevate public discourse and improve public decision-making.
3) Adaptable Analytic and Critical Thinking Skills: Applied policy analysis requires researchers to pivot their policy focus to address constantly shifting policy priorities.
4) Place-Based Research: To exercise applied policy analysis in an interdisciplinary context, policy research must be place-based. Real policy analysis, based on real data, applied to actual geographic and political settings is a strength of the program.

The core curriculum provides the skills needed to pursue varied policy domains, adapt to changing policy environments, and clearly communicate research results to shape policy outcomes. Students become versed in analytical techniques suitable for research and policy analysis to address substantive issues and problems in varied geographic and political contexts.

Students graduate with expertise in a specific policy field. Students have flexibility in identifying their policy field. The multidisciplinary nature of the program allows students to develop a cutting-edge policy field as they work with faculty across disciplines and colleges. Students are provided multiple opportunities to conduct guided research both within and outside of their policy field. Examples of the policy field include, but are not limited to:

- Community Development
- Economic Policy
- Economic Development Policy
- Education Policy
- Election Policy
- Energy Policy
- Environmental Policy
- Food and Nutrition Policy
- Health Policy
- Infrastructure Policy
- Justice Policy
- Peace and Conflict Policy
- Policy Process
- Political Institutions
- Social Policy
- Trade Policy
- Transportation Policy
- Urban and Regional Development

Admission Requirements
The following are general guidelines for successful admission into the Ph.D. in Public Policy degree program:

1) A master's degree in a social science or other field related to policy studies with a GPA of at least 3.3 is required for admission to full standing in the Ph.D. in Public Policy program.
2) Students with baccalaureate degrees may be admitted on a conditional basis if they have an overall undergraduate GPA of at least 3.5 and are currently enrolled in a master's level program at UNC Charlotte in a field related to policy studies. However, such students will not formally be admitted to the Ph.D. program until completion of the requirements for the master's degree.

3) Admission to the program requires strong scores (at least at the fiftieth percentile) on the Graduate Record Examination (GRE) or the GMAT. The GMAT/GRE can be waived if one of the following conditions are met:
   - Master's degree from a college or university accredited by an accepted accredited body with a minimum cumulative graduate GPA of 3.0, AND a minimum GPA of 3.0 in all Economics and/or Statistics courses completed at the undergraduate and/or graduate level, AND at least two years of relevant, professional work experience, OR
   - Completion of at least 9 credit hours in the UNC Charlotte Graduate Certificate in Public Policy Research and Analysis program with a minimum cumulative GPA of 3.33.
   - The waiver must be requested from the Public Policy Doctoral Director via email when submitting the completed application. Please include "PPOL GRE Waiver" in the subject line. All GRE/GMAT waivers are at the discretion of the Public Policy Doctoral Director. If candidates are unable to secure the GRE/GMAT waiver, they will be required to submit official GRE/GMAT test scores with their application.
4) Three strong, positive letters of recommendation, at least two of which must come from faculty in the student's previous academic programs. All letters should be written by individuals in a position to judge the applicant's likely success in a Ph.D. level program. Letters should address the applicant's suitability for a Ph.D. program and ability to complete the program in a timely fashion. Letters from the student's master's level program are preferred.
5) Admission to the program of students who are not native English speakers requires strong scores on the TOEFL exam. The TOEFL exam is a required part of the application package for non-native English speakers.
6) Students entering the program are expected to remedy any coursework deficiencies identified by the Admissions Committee and Program Director in the first semester after enrolling in the program. The amount and kinds of remedial coursework required for the program depends on the background of the student and are established by the Admissions Committee and the Program Director. Possible deficiencies are indicated in the prerequisites for the required core courses of the program. This program emphasizes the quantitative and analytical skills necessary to confront the challenges of contemporary policy dilemmas that communities face at the local, state, federal, and international levels.

Documents for Admission

1) Official transcripts from all colleges and universities attended
2) Official GRE scores (verbal, quantitative, and analytical writing) or GMAT scores (verbal, quantitative, analytical writing, and integrated reasoning).
3) UNC Charlotte application for graduate admission form
4) Three letters of reference from academics who have taught or worked directly with the applicant
5) An essay that addresses professional goals and motivation for pursuing the degree, suitability for the program, career goals following the degree, and potential areas of policy field the applicant would pursue within the program
6) TOEFL scores (if the student is not a native English speaker)

Admission Assessment

1) An Admissions Committee reviews applications and recommends to the Program Director whether each applicant should be admitted and, if so, under what conditions.
2) The program's Admissions Committee assesses each student's previous academic coursework in light of the student's stated direction of study. This assessment is used to identify the strengths and weaknesses of the student's previous academic history and to suggest specific coursework for the student's public policy program. Any remedial coursework required for the program depends on the student's background and will be established by the Admissions Committee and the Program Director. The Admissions Committee may also suggest specific coursework based on the student's intended direction of study within the program. The Admissions Committee conducts this assessment upon the student's acceptance and formal declaration of intent to attend. For each entering student, the Director of the Public Policy program serves as his or her major advisor for the first year in the program before the student chooses his or her committee chair.

Student Responsibility

Students entering the program must present evidence that their background is sufficient to undertake the coursework required of them. Such evidence ideally should include some combination of:

1) Familiarity with political and legal processes, behaviors, and institutions
2) A graduate level social science methods or statistics course
3) College coursework in both macro- and microeconomics
4) Substantial background in a public policy specialty area

Students may have completed appropriate courses to provide this background elsewhere. Normally, transcripts provide the evidence required by the Admissions Committee; however, if the student's previous experience is offered as evidence, the student must document such experience. A more detailed list of the types of prerequisite coursework can be found online at publicpolicy.charlotte.edu.

Degree Requirements

The total number of credit hours is established by the student's advisor according to a plan of study that must be presented after the successful completion of 18 credit hours of coursework. The Ph.D. program requires 29 credit hours of core course credit, at least 6 credit hours of advanced analysis coursework, 18 credit hours of dissertation credit (enrollment contingent on admission to candidacy), and a minimum of 12 credit hours for policy field courses. Students can complete the program with 65 credit hours, but will likely take more. Students progress through the program in five stages:

1) Core Courses
2) Qualifying Examinations
3) Advanced Analysis Coursework and Specialty Policy Field Courses
4) Dissertation Proposal Defense
5) Dissertation

Core Courses (29 credit hours)

Professional policy researchers must have a foundation of theoretical and research skills that are transferrable across policy foci. Students are provided a strong foundation in theory and methods.

Nature of the Field Courses (11 credit hours)

Professional policy researchers require a variety of tools to assess policies and develop policy recommendations. All students are required to take courses to understand the nature of the field. Students learn to critically assess the current policy literature (PPOL 8600), design a research study (PPOL 8602), and consider the ethical implications of their work (PPOL 8635). Students also take two professionalization seminars (PPOL 8690) that assist with career development and help students develop the soft skills necessary for a career in Public Policy.

PPOL 8600 - Policy Process I (3)
PPOL 8602 - Research Design in Public Policy (3)
PPOL 8635 - Ethics of Public Policy (3)
PPOL 8690 - Seminar in Public Policy (1*) (taken at least 2 semesters)**

** Students in the program develop their appreciation of the varied nature of policy applications and improve their communication skills by participating in at least two seminar series throughout the course of their program. Seminars also serve as a clearinghouse, introducing students to the varied faculty in the program. Students engage in activities aimed at professional development for both practitioners and for those interested in pursuing careers in academia.*

Methods of Analysis Courses (12 credit hours)

Public policy researchers and scholars must have a strong foundation in research methods. All students are required to take GRAD 8101 and PPOL 8630 to develop this foundation. Students also complete two studio courses that provide hands-on research experiences. PPOL 8101 (taken before GRAD 8101) will provide hands-on experience with data management and analysis using the R statistical software package. PPOL 8102, taken after GRAD 8101, provides an opportunity for a guided research experience where students complete an independent research project under the guidance of the faculty.

GRAD 8101 - Linear Regression (3)
PPOL 8630 - Advanced Program Evaluation (3)

Economic Analysis Courses (6 credit hours)

A strong foundation in economics is critical for effective policy analysis. Students are required to take 6 credit hours in the economic analysis of public policy.

PPOL 8640 - Economic Analysis of Public Policy I (3)
PPOL 8641 - Economic Analysis of Public Policy II (3)

Advanced Analysis Courses (6 credit hours)

Advanced analytic skills prepare policy researchers to tackle a variety of complex research studies. Prior to defending a dissertation proposal, students must complete at least six (6) credit hours of advanced analysis coursework at the doctoral level. Students are encouraged to choose courses that cover the types of analysis that are prevalent in the student's policy area of interest. Students may select from the following list or take courses in other departments with permission of the Program Director. Students are strongly encouraged to take additional advanced analytic courses, as possible. Expertise in diverse methods is critical for a policy research career.

BPHD 8120 - Econometrics I (3)
BPHD 8130 - Econometrics II (3)
GRAD 8009 - Topics in Graduate Studies (3) *(topic in advanced analysis)*
GRAD 8101 - Linear Regression (3)
GRAD 8102 - Categorical Outcomes (3)
GRAD 8103 - Classificatory Methods and Time Series (3)
GRAD 8104 - Spatial Statistics (3)
PPOL 8622 - Qualitative Methods in Public Policy (3)
PPOL 8625 - Advanced Seminar in Spatial Decisions Support Systems (3)

Policy Field Courses (12 credit hours)

The Policy Field allows students to select an area of focus that culminates in a dissertation. Students have flexibility in defining this field, in consultation with the director and the advisor. 12 credit hours are required for the policy field. Three of these credit hours must be an independent study in which students develop a reading list, in consultation with the advisor. Three of the credit hours must be a focused research experience. The final six credit hours can include any combination of an independent study, an elective PPOL course, or an elective from any graduate level program across the university with advisor or program director approval. This student-centered approach to creating the policy field allows students flexibility in identifying innovative, multidisciplinary policy expertise. This expertise is complemented by hands-on research in PPOL 8602 and 18 dissertation credit hours. Students are encouraged to take additional courses aligned with their policy field, as relevant.

Required Policy Field Courses (6 credit hours)

PPOL 8800 - Independent Study (1 to 3)
PPOL 8802 - Independent Study II: Public Policy Research Experience (3)

Elective Policy Field Courses (6 credit hours)

Students should choose two additional courses that align with their Policy Field. These courses may include elective courses from any graduate level program across the University with advisor or program director approval. This permits students flexibility in identifying innovative policy fields. Examples of courses in the Ph.D. in Public Policy program that could count toward the elective include, but are not limited to:

BPHD 8120 - Econometrics I (3)
BPHD 8130 - Econometrics II (3)
PPOL 8000 - Topics in Public Policy (1 to 4)
PPOL 8610 - The Urban Region (3)
PPOL 8611 - Metropolitan Governance and Administration (3)
PPOL 8612 - Theory of Urban Development (3)
PPOL 8613 - Transportation Policy (3)
PPOL 8615 - The Restructuring City (3)
PPOL 8616 - Urban Planning Theory and Practice (3)
PPOL 8617 - Law and Management (3)
PPOL 8618 - Growth Management Systems (3)
PPOL 8622 - Qualitative Methods in Public Policy (3)
PPOL 8625 - Advanced Seminar in Spatial Decisions Support Systems (3)
PPOL 8636 - The Social Context of Mental Health (3)
PPOL 8642 - Regional Economic Development (3)
PPOL 8643 - Rural Development Issues (3)
PPOL 8644 - Public Budgeting and Financing (3)
PPOL 8650 - Environmental Policy (3)
PPOL 8652 - Energy and Environmental Economics (3)
PPOL 8653 - Urban Air Quality (3)
PPOL 8655 - Watershed Science Policy (3)
PPOL 8656 - Earth Systems Analysis: Biogeochemical Cycles (3)
PPOL 8661 - Social Organization of Healthcare (3)
PPOL 8663 - Health Policy (3)
PPOL 8665 - Analytic Epidemiology (3)
PPOL 8667 - Economic of Health and Healthcare (3)
PPOL 8669 - Investigating Health and Health Services (3)
PPOL 8671 - Criminal Justice Policy (3)
PPOL 8672 - Theories of Crime and Justice (3)
PPOL 8673 - Law and Social Control (3)
PPOL 8681 - Race, Gender, Class, and Public Policy (3)
PPOL 8682 - Stratification and Social Policy (3)
PPOL 8683 - Population Dynamics and Social Policy (3)
PPOL 8685 - Aging and Social Policy (3)
PPOL 8687 - Education Policy (3)
PPOL 8688 - Political Economy of School Reform (3)
PPOL 8689 - The Social Context of Schooling (3)
PPOL 8690 - Seminar in Public Policy (1)
PPOL 8701 - Advanced Macroeconomic Theory (3)
PPOL 8703 - Advanced Microeconomic Theory (3)
PPOL 8705 - Advanced Urban and Regional Economics (3)
PPOL 8707 - Game Theory and Experiments (3)
PPOL 8709 - Public Economics (3)
PPOL 8711 - Monetary and Financial Theory (3)

Dissertation (18 credit hours)

The program requires that the student complete 18 hours of dissertation credit. Enrollment in dissertation credit is contingent on admission to candidacy. The dissertation topic may be proposed after the student has passed the qualifying exams. The doctoral student advances to candidacy after the dissertation proposal has been defended to, and approved by, the student's advisory committee and reported to the Director of the Ph.D. in Public Policy and the Dean of the Graduate School. The student must complete and defend the dissertation based on a research program approved by the student's dissertation committee that results in a high quality, original, and substantial piece of research.

PPOL 8801 - Dissertation (1 to 9)

Degree Total = 65 Credit Hours

Grade Requirements

A student must maintain a cumulative average of 3.0 in all coursework taken for graduate credit. An accumulation of three C grades will result in termination of the student's enrollment in the graduate program. If a student receives a grade of U in any course, enrollment in the program will be terminated.

Admission to Candidacy

After completing the core courses, students are required to write a qualifying examination covering the nature of the field, methodology, and economic analysis skills. After

completing the qualifying examination, students take their policy field courses. Successful completion of core courses and the qualifying examinations allows students to proceed to the dissertation proposal preparation and defense stage. The dissertation proposal defense includes an oral presentation and written proposal. Prior to the proposal defense, with the guidance of their advisor, students develop a topic paper that outlines the policy area on which their dissertation will focus. After a topic approval meeting, students develop that topic paper into a full proposal. During the oral component of the proposal defense, the student addresses not only the specific research topic about which they will write but situates that topic in the larger body of relevant policy literatures; the defense serves as the comprehensive examination. Procedures for establishing the dissertation committee are addressed in the *Student Handbook* and in the Public Policy Seminar course.

Advising/Committees

While the Program Director serves as the *de facto* advisor for each student for the first year, the Program Director works with the students and faculty to help the student work with a suitable advisor. Once the student is matched with the advisor, they work closely with that advisor on suggested schedules of classes, research options, and other issues important to success. After approximately one year in the program, each student is expected to have identified the faculty member with whom they would like to mentor, with the expectation that this mentor would ultimately serve on the student's committees. Following completion of the policy field courses, students establish their dissertation advisor and form a dissertation committee. The procedures for establishing these committees are in the *Student Handbook* and are addressed in the Public Policy Seminar.

Application for Degree

Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar. After successful defense of the dissertation, a student will be conferred with the doctoral degree.

Assistantships

The Ph.D. in Public Policy is committed to academic year funding for all full-time students. Additional support for summer sessions may be available through program funds and research grants working with program faculty. Available options for funding include graduate assistantships, teaching assistantships for those interested in careers in academia, and scholarships. For more information on funding options, contact the Director of the Public Policy Program.

Research Opportunities

The Ph.D. Program in Public Policy has an extensive pool of professors to enhance the research opportunities and experiences for the students. Each program of study could be individually tailored for the research of the student with the possibility of individual studies under the supervision of an advisor.

Residency Requirement

Students must satisfy the residency requirement for the program by completing 21 hours of continuous enrollment, either as coursework or dissertation credits. Residence is considered continuous if the student is enrolled in one or more courses in successive semesters until 21 hours are earned. All 18 hours of dissertation credit must be earned at UNC Charlotte.

Time Limits for Completion

The student must achieve admission to candidacy within six years after admission to the program. All requirements for the degree must be completed within nine years after first registration as a doctoral student. These time limits are maximums; full-time students will typically complete the degree requirements in five years.

Transfer Credit

The Program will accept up to two courses in the core curriculum as transfer credit from a college or university accredited by an accepted accrediting body, providing that the Admissions Committee determines that these courses are equivalent to those offered in the core or one of the specialty areas. The acceptance of transfer credit is subject to the approval of the Graduate School. The grade in these transfer credits must have been A or B. All of the dissertation work must be completed at UNC Charlotte.

Graduate Certificate in Public Policy Research and Analysis

The Graduate Certificate in Public Policy Research and Analysis provides students with a strong grounding in the processes through which public policies are designed, passed, implemented, and evaluated in conjunction with the training in quantitative and analytic skills necessary to carry out applied public policy research and analysis. The program requires the completion of 15 credit hours. The certificate must be completed within four years of admission, and students may apply credits earned towards a graduate degree program in conjunction with or after the certificate has been awarded.

Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for admission into the Graduate Certificate in Public Policy Research and Analysis:

- A bachelor's degree or master's degree (or its equivalent) from a college or university accredited by an accepted accrediting body
- Official transcripts of all college coursework attempted
- A GPA of 3.0 or above on a 4.0 scale for all prior coursework completed beyond secondary school (high school)
- Official and satisfactory scores on the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IIELTS), if English is not the student's native language and if they have not earned a post-secondary degree from a U.S. or English-speaking institution
- An online application for the program through the Graduate School's application system

Recommended qualifications include:

- Submission of Graduate Record Exam (GRE) scores showing strong proficiency in math and verbal aptitude
- Completion of one or more social science statistics or econometrics courses prior to entering the program

Certificate Requirements

Core Courses in Research and Design (9 credit hours)

PPOL 8600 - Policy Process I (3)
PPOL 8602 - Research Design in Public Policy (3)
PPOL 8630 - Advanced Program Evaluation (3)

Quantitative Analysis Methods Course (3 credit hours)

Select one of the following:
GRAD 6100 - Basic Statistics and Probability (3)
GRAD 6101 - Linear Regression (3)
GRAD 6102 - Categorical Outcomes (3)
GRAD 6103 - Classificatory Methods and Time Series (3)
GRAD 6104 - Spatial Statistics (3)
GRAD 8101 - Linear Regression (3)
GRAD 8102 - Categorical Outcomes (3)
GRAD 8103 - Classificatory Methods and Time Series (3)
GRAD 8104 - Spatial Statistics (3)

Elective Course (3 credit hours)

Select one of the following or seek approval from the Graduate Program Director for an alternative elective course numbered at the 6000 level or above:
GRAD 8101 - Linear Regression (3)
GRAD 8102 - Categorical Outcomes (3)
GRAD 8103 - Classificatory Methods and Time Series (3)
GRAD 8104 - Spatial Statistics (3)
PPOL 8622 - Qualitative Methods in Public Policy (3)
PPOL 8635 - Ethics of Public Policy (3)
PPOL 8640 - Economic Analysis of Public Policy I (3)
PPOL 8701 - Advanced Macroeconomic Theory (3)
PPOL 8703 - Advanced Microeconomic Theory (3)

Certificate Total = 15 Credit Hours

Grade Requirements

Students must maintain a minimum GPA of 3.0 across all certificate coursework, with no more than one grade of C among courses that apply towards the certificate.

RELIGIOUS STUDIES

- M.A. in Religious Studies

Department of Religious Studies
religiousstudies.charlotte.edu

M.A. in Religious Studies

The M.A. in Religious Studies program approaches the academic study of religion and religions from a variety of critical and interdisciplinary perspectives, with an emphasis placed on the global and multicultural aspects of religion. The department offers courses in theories and methods as well as a variety of religious traditions, studied in their historical and contemporary manifestations.

Admission Requirements
In addition to meeting the University's graduate admission requirements, all prospective students must submit an essay (statement of purpose) that specifically addresses their motivation for pursuing the M.A. in Religious Studies, including some discussion of their research interests and career or professional goals.

Test Scores Waiver
Students graduating with a bachelor's degree from the UNC Charlotte Department of Religious Studies are exempt from submitting standardized test scores for admission. Students who have received a 3.2 GPA or above from a college or university accredited by an accepted accrediting body are also exempt from submitting standardized test scores. All other students must submit GRE or MAT standardized test scores as part of their application. Standardized test scores and letters of reference can be no more than five years old.

Early Entry Program
Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements
The Master of Arts in Religious Studies requires the completion of a minimum of 30 credit hours of approved graduate coursework. At least 15 credit hours of this total must be in courses open only to graduate students (i.e., at the 6000 level or higher). Students have two options for completing their degree: (1) Students may complete an M.A. Thesis option that consists of 24 credit hours of coursework and 6 credit hours of thesis work; or (2) Students may complete a comprehensive examination option consisting of 30 credit hours of coursework and comprehensive examinations in three areas. All degree requirements must be completed within seven calendar years of first enrollment in the program. Up to 6 credit hours earned from a college or university accredited by an accepted accrediting body may be eligible for transfer credit. Formal approval must be obtained from the Graduate Program Director and the Dean of the Graduate School.

Core Courses (6 credit hours)
All M.A. candidates must complete the following courses with grades of B (3.0) or above within three semesters of their initial admission into the program.

RELS 6101 - Approaches to the Study of Religion (3)
RELS 6102 - Teaching in the Humanities (3)

Elective Courses
Students work with their advisor to select elective courses. Up to 6 hours of related graduate credit may be earned outside the Department of Religious Studies. Such courses must be formally approved by the Graduate Program Director.

Degree Total = 30 Credit Hours

Grade Requirements
A GPA of 3.0 or above is required for the minimum of 30 credit hours of approved graduate coursework.

Advising
The Graduate Program Director serves as formal advisor to the department's graduate students.

Application for Degree
Each student should make application for their degree by completing the online Application for Degree through Banner Self Service no later than the filing date specified in the University Academic Calendar.

Foreign Language Requirement
Although students are not required to demonstrate proficiency in a foreign language as a formal matriculation requirement of the program, they are expected to acquire competency in and use whatever languages they need to pursue their research interests.

Committees for Thesis and Examination Options
Three-member faculty committees, consisting of two graduate faculty members from the Department of Religious Studies and a third member selected from Religious Studies or another department, conduct the

comprehensive examinations and oversee the student's thesis work. For those choosing the exam option, one of the examining faculty members will be the student's instructor for RELS 6101.

SOCIOLOGY

- M.A. in Sociology
  - Applied Social Research

Department of Sociology
sociology.charlotte.edu

M.A. in Sociology

The Master of Arts in Sociology provides students with theoretical and methodological skills necessary to undertake analysis of contemporary social issues and problems. The curriculum is designed to meet the needs of students seeking master's level research skills for occupations requiring such expertise: in government, marketing, program planning and evaluation, business, the media, and in the nonprofit sector. The curriculum also prepares students who wish to pursue the Ph.D., whether in sociology or a related discipline. The Department of Sociology is a core part of the Ph.D. programs in Public Policy and Organizational Science at UNC Charlotte.

Coursework concentrates on building skills in research design, sampling, data analysis, interpretation and sociological theory. Students complete either a thesis, with oral defense, or a research practicum. Either option entails the student applying sociological knowledge to a problem/topic of their interest. In addition to traditional classroom courses, students can tailor their coursework to specific areas of interest through individualized tutorials. A variety of research interests are represented among the Sociology faculty. Among these are Education, Healthcare, Group Processes (Social Psychology), Social Movements, Stratification, Organizations, and Mathematical Sociology. Through coursework and tutorials students can gain a substantive knowledge base that complements their social research skills.

An optional Concentration in Applied Social Research is available. It is designed for students who want to further develop their skills for applied social research. It is an ideal option for students who are interested in using their sociological training to analyze social issues and to solve practical problems. This concentration can be completed in one year of study.

Admission Requirements
- An overall undergraduate GPA of 3.0 or above
- Demonstrate undergraduate competence in research methods, theory and statistics for social research
- 18 credit hours of social science undergraduate courses

- Complete application submitted online through the Graduate School's application system including: statement of purpose (essay); three letters of recommendation; transcript(s) of all academic work attempted beyond high school; official GRE scores (optional); and resume

Note: Standardized test scores (e.g., GRE, GMAT, MAT) are optional, but not required.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The program requires 35 credit hours of coursework. To provide all students with a solid grounding in theory and methods of sociological inquiry, 15 credit hours of core courses are required. In addition to the core, students take elective courses and may elect an optional concentration. Finally, students must complete either a thesis or a research practicum (the research practicum is required for students in the concentration).

Core Courses (15 credit hours)

SOCY 5151 - Pro-Seminar: Social Problems and Social Policy (3)
SOCY 6651 - Social Theory (3)
SOCY 6652 - Issues in Social Research (3)
GRAD 6100 - Basic Statistics and Probability (3)
GRAD 6101 - Linear Regression (3)*

**The Graduate Program Director may waive the requirement for GRAD 6100 if the student presents evidence of quantitative skills comparable to what is learned in the course. This would not alter the number of credit hours required for the major.*

Concentration Requirements (12 credit hours)

Students may complete the M.A. in Sociology without a formal concentration or with an optional concentration.

No Concentration

Students not electing an optional concentration must complete the following requirements for their degree program.

Restricted Elective Courses (6 credit hours)
Select at least two SOCY courses.

Thesis or Research Practicum (6 credit hours)
Students select to do either a thesis or research practicum. Students choosing the thesis formulate a theoretically motivated or applied research question or argument and collect or analyze existing empirical data to answer that question.

As an alternative to the traditional thesis, students have the option of a research practicum. This may be combined with an internship. The student works with an organization or agency to complete a research evaluation project for the agency.

Select one of the following:
SOCY 6897 - Research Practicum (1 to 6)
SOCY 6996 - Thesis (1 to 6)

Applied Social Research Concentration

Students in this concentration must complete the core curriculum for the M.A. in Sociology and choose the research practicum option in lieu of the thesis requirement. At least two additional courses in research methods must also be completed for a minimum of 6 credit hours.

Research Practicum (6 credit hours)
Students must complete 6 credit hours of Research Practicum. The last 3 credit hours must be taken in the final semester.

Elective Courses (6 credit hours)
Students must complete at least 2 elective courses in research methods for a minimum of 6 credit hours. Electives are to be chosen, in consultation with committee members, from the following courses. Students may petition to use appropriate courses not listed below as substitutes to fulfill their concentration requirement.

GRAD 6102 - Categorical Outcomes (3)
GRAD 6103 - Classificatory Methods and Time Series (3)
GRAD 6104 - Spatial Statistics (3)
GRAD 6340 - Data Analysis and Presentation for Impact (2)
SOCY 6136 - Qualitative Research Methods (3)
SOCY 6617 - Data Utilization (3)
SOCY 6640 - Evaluation Research for Applied Sociology (3)

Unrestricted Elective Courses (8 credit hours)

Subject to the approval of the Graduate Program Director, students may take elective courses (up to 6 credit hours) from other departments as long as courses are at the graduate level (5000 or above) and the student's areas of interest overlap with other programs (e.g., psychology, education, organizational science, public policy, history, geography). Courses taught in other programs (e.g., Public Policy, Organizational Science) by Sociology faculty do not count as coursework outside of the department.

Degree Total = 35 Credit Hours

Grade Requirements
Students must earn a grade of B above in each course required for the program. Two grades of C from courses taken inside or outside of the Department of Sociology will result in suspension from the program. Students wishing to re-enter the program must reapply. Readmission is not guaranteed. The application must address causes of poor performance and an amelioration plan. Readmitted students must retake any courses where a grade of C was earned. Two additional grades of C will result in permanent expulsion from the program.

Admission to Candidacy
Completion of at least 24 credit hours of required coursework is required for admission to candidacy.

Advising
The Graduate Program Director advises all graduate students until they select a person to serve as their Committee Chair.

Assistantships
The Department of Sociology offers both teaching assistantships and research assistantships; the latter are dependent upon faculty research funding. Teaching assistants assist faculty with coursework, or teach the undergraduate lab sections in research methods and statistics. They are paid approximately $10,000 for nine months of twenty hours per week work during the academic year. The workload and pay for research assistants varies. Assistantships are awarded on the basis of merit and experience.

Committee
The student's committee shall consist of three faculty members: the Chair and two other individuals who assist with completion of the thesis or research practicum. One member of the committee, not the chair, may be from outside the department.

Financial Assistance
Other than the assistantships and waivers described above, the Department offers the Pearson Fellowship, which is awarded annually to a graduate or undergraduate student who has interests and goals in improving race relations, expanding social justice, and establishing a more peaceful world. The award is made every spring and consists of $1,000 to be applied to tuition at UNC Charlotte.

Internships
While there is no formal system of ongoing internships, agencies do contact the department to find students who would be interested in an internship. Consequently, internships are optional and dependent upon a match between an agency's needs and a student's skills and interests.

Research Opportunities/Experiences
Faculty members are actively engaged in research and students are strongly recommended to work with faculty to develop research expertise. In addition, a number of faculty members have funded research projects or internships on which qualified graduate students are able to work.

Transfer Credit
With departmental approval, students may transfer in up to six credit hours of graduate work for which the applicant received a grade of B or above from another institution, related UNC Charlotte degree program or related post-baccalaureate work.

School of Data Science

datascience.charlotte.edu

UNC Charlotte's School of Data Science (SDS) is committed to growing exemplary talent through research and education. The School offers undergraduate and graduate degree programs and certificates that combine the fields of science, business, mathematics, social science, and sports. In strategic collaboration with industry and regional partners, the School is educating the next generation of data scientists, business analysts, and managers with the technical and critical thinking skills to model the world through data.

Graduate Degree Programs

- M.S. in Data Science and Business Analytics
- M.S. in Health Informatics and Analytics
- Master of Health Administration/M.S. in Health Informatics and Analytics Dual Degree *(see under Health Administration in the "College of Health and Human Services" section)*
- Master of Public Health/M.S. in Health Informatics and Analytics Dual Degree *(see under Public Health in the "College of Health and Human Services" section)*

Graduate Non-Degree Programs

- Graduate Certificate in Data Science and Business Analytics
- Graduate Certificate in Health Informatics and Analytics
- Graduate Certificate in Applied Nursing Informatics *(see under Nursing in the "College of Health and Human Services" section)*

DATA SCIENCE AND BUSINESS ANALYTICS

- M.S. in Data Science and Business Analytics
- Graduate Certificate in Data Science and Business Analytics

Graduate Program

dsba.charlotte.edu

The program in Data Science and Business Analytics (DSBA) is a joint venture between the Belk College of Business, College of Computing and Informatics, and the Graduate School at UNC Charlotte. The program offers both a Graduate Certificate and a Master of Science degree designed to prepare students for the complex and rapidly changing data science and business analytics environment.

M.S. in Data Science and Business Analytics

The M.S. in Data Science and Business Analytics (DSBA) is

an interdisciplinary program at the intersection of business, computer and information sciences, statistics, and operations research. The program leads to an M.S. in Data Science and Business Analytics. It is a unique blend of business acumen, data understanding, exposure to a diverse set of advanced analytics methods, and hands-on experience designed to help students apply learned knowledge on representative business problems. DSBA graduates are well equipped for employment in a wide variety of data intensive industries, such as financial services, energy, retail/supply chain, or healthcare, where the need for business analysts with quantitative, computational, and sophisticated analytical skills is growing at an explosive pace.

Admission Requirements

Applicants must meet the general Graduate School requirements for admission to master's degree programs. Applications must include all of the materials listed by the Graduate School as typical for master's degree application submissions. In addition to the general requirements for admission to the Graduate School, an earned baccalaureate degree from a college or university accredited by an accepted accrediting body in any scientific, engineering, or business discipline or a closely related field is required. Official GRE or GMAT scores are required for all applicants without an earned baccalaureate degree or higher from a U.S. college or university accredited by an accepted accrediting body. Applicants who do not meet a minimum undergraduate GPA of 3.0 (4.0 scale) require GRE or GMAT scores.

In addition, prior to matriculation, the program requires:

- A current working knowledge of at least one higher-level (procedural) language; and a familiarity with computer applications
- A minimal background in mathematics is also required, including two semesters of calculus and one semester of statistics

Individuals who have worked at a high professional level in the computer industry or business may be able to substitute work experience for specific subject area admission requirements. Individuals without a business degree or business experience are required to complete an online business fundamentals course prior to enrolling in the program.

GRE/GMAT Waiver

The GRE/GMAT requirement may be waived for applicants who meet one of the following:

- Hold a terminal degree (e.g., J.D., M.D., D.D.S., or Ph.D.)
- Have successfully completed a minimum of two of the required courses in the Graduate Certificate in Data Science and Business Analytics with a GPA of 3.5 or above, and a letter of recommendation from at least one of the DSBA course instructors

Waiver from GRE/GMAT must be requested from the DSBA Graduate Program Director when submitting the completed application. All waivers are at the discretion of the DSBA Graduate Program Director. Applicants satisfying one of the above criteria may be asked by the DSBA Graduate Program Director to report GRE/GMAT scores.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Accelerated Master's Program

Academically talented high school seniors and UNC Charlotte undergraduate freshmen are encouraged to apply for the Accelerated Master's Program to begin work toward both undergraduate and graduate degrees in their Freshman year. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Accelerated Master's Programs.

Degree Requirements

Thirty-three graduate credit hours are required for the DSBA PSM. Of the 33 graduate credit hours, 21 credit hours are required core courses (inclusive of 3 credit hours for the internship), and 12 credit hours of elective courses. A minimum of 21 credit hours contributing to the M.S. in Data Science and Business Analytics must be from courses numbered 6000 or higher. A maximum of 6 hours of graduate credit may be transferred. Students may apply all of the credit hours earned in the Graduate Certificate in Data Science and Business Analytics toward the M.S. in Data Science and Business Analytics with the approval of the DSBA Graduate Program Director.

Required Courses (21 credit hours)

DSBA 5122 - Visual Analytics and Storytelling (3)
DSBA 6156 - Machine Learning (3)
DSBA 6160 - Database Systems for Data Scientists (3)
DSBA 6201 - Business Intelligence and Analytics (3)
DSBA 6211 - Advanced Business Analytics (3)
DSBA 6276 - Strategic Business Analytics (3)
DSBA 6400 - Internship (3)

Elective Courses (12 credit hours)
Select four from the following. At least one course must be from the list of Data Science Elective Courses and one must be from the list of Business Analytics Elective Courses.

Data Science Elective Courses
DSBA 6112 - Graduate Econometrics (3)
DSBA 6122 - Decision Modeling and Analysis (3)
DSBA 6188 - Text Mining and Information Retrieval (3)
DSBA 6207 - Business Project Management (3)
DSBA 6208 - Supply Chain Management (3)
DSBA 6212 - Enterprise Systems (3)
DSBA 6213 - Applied Healthcare Business Analytics (3)
DSBA 6277 - Social Media Marketing and Analytics (3)
DSBA 6278 - Innovation Analytics (3)

Business Analytics Elective Courses
DSBA 6010 - Special Topics in Data Science and Business Analytics (3)
DSBA 6100 - Big Data Analytics for Competitive Advantage (3)
DSBA 6112 - Graduate Econometrics (3)
DSBA 6122 - Decision Modeling and Analysis (3)
DSBA 6207 - Project Management (3)
DSBA 6208 - Supply Chain Management (3)
DSBA 6277 - Social Media Marketing and Analytics (3)
DSBA 6278 - Innovation Analytics (3)
DSBA 6345 - Modern Data Science Systems (3)
DSBA 6284 - Digital Marketing Analytics (3)

Other Elective Courses
DSBA 5110 - Applied Regression Analysis (3)
DSBA 6010 - Special Topics in Data Science and Business Analytics (3)
DSBA 6115 - Statistical Learning with Big Data (3)
DSBA 6170 - Ethics, Privacy, Security and Governance of Big Data (3)

Degree Total = 33 Credit Hours

Graduate Certificate in Data Science and Business Analytics

The Graduate Certificate in Data Science and Business Analytics (DSBA) provides post-baccalaureate students with the opportunity to reach a demonstrated level of competence in the area of data science and business analytics. The certificate requires 15 graduate credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

The Graduate Certificate in DSBA is open to all students who:

- Hold a B.S. or M.S. degree in any scientific, engineering, or business discipline
- Are either (a) enrolled and in good standing in a graduate degree program at UNC Charlotte or (b) complete their undergraduate degree with a minimum 2.75 GPA

In addition, the program requires a current working knowledge of at least one higher-level (procedural) language; and a familiarity with computer applications. A minimal background in mathematics is also required, including two semesters of calculus and one semester of statistics. Individuals who have worked at a high professional level in the computer industry or business may be able to substitute work experience for specific subject area admission requirements. Individuals without a business degree or business experience are required to complete an online business fundamentals course prior to enrolling in the program. Transfer credit from another institution is not accepted into this certificate program.

Certificate Requirements

The certificate is awarded upon completion of five graduate level courses (15 credit hours) in the area of data science and business analytics.

Required Core Courses (6 credit hours)
DSBA 6100 - Big Data Analytics for Competitive Advantage (3)
DSBA 6201 - Business Intelligence and Analytics (3)

Elective Courses (9 credit hours)
Select three from the following. At least one course must be from the list of Foundational Elective Courses.

Foundational Elective Courses
DSBA 5122 - Visual Analytics and Storytelling (3)
DSBA 6276 - Strategic Business Analytics (3)

Elective Courses
DSBA 6122 - Decision Modeling and Analysis (3)
DSBA 6156 - Applied Machine Learning (3)
DSBA 6188 - Text Mining and Information Retrieval (3)
DSBA 6211 - Advanced Business Analytics (3)
DSBA 6284 - Digital Marketing Analytics (3)
DSBA 6520 - Network Science (3)

Certificate Total = 15 Credit Hours

Grade Requirements

A cumulative GPA of 3.0 is required and, at most, one course with a grade of C may be allowed towards the certificate.

HEALTH INFORMATICS AND ANALYTICS

- M.S. in Health Informatics and Analytics
  - Data Science
  - Health Services Outcomes
- MHA/M.S. in Health Informatics and Analytics Dual Degree *(see under Health Administration in the "College of Health and Human Services" section)*
- MPH/M.S. in Health Informatics and Analytics Dual Degree *(see under Public Health in the "College of Health and Human Services" section)*
- Graduate Certificate in Health Informatics and Analytics

Graduate Program

hi.charlotte.edu

M.S. in Health Informatics and Analytics

Health Informatics and Analytics is an interdisciplinary program within the School of Data Science that leverages and capitalizes on the strength of its parent colleges, the College of Health and Human Services and the College of Computing and Informatics, to prepare national and international students to advance the professional practice of Health Informatics through a thorough grounding in data science, and health analytics.

This mission is pursued through education, research, and service efforts that:

- Provide qualified and motivated students from a variety of disciplines, levels of experience, and backgrounds - with a special emphasis on individuals and groups historically underrepresented in graduate education - the knowledge, skills, and abilities to become exemplary practitioners of and advocates for health informatics
- Contribute to the body of knowledge related to the design, operation, and analysis of healthcare information systems and health-related data across multiple scales
- Apply expertise to support health leaders and the communities they serve in, advancing the public's health

The Health Informatics and Analytics program is the nation's premier program in developing practitioners who bridge data sciences and analytics in support of optimal population health.

Admission Requirements

Applicants must meet the general Graduate School requirements for admission to master's degree programs. Applications must include all of the materials listed by the Graduate School as typical for master's degree application submissions. In addition to the general requirements for admission to the Graduate School, an earned baccalaureate degree from a college or university accredited by an accepted accrediting body in computer sciences, health sciences, information systems, or life sciences or in an informatics discipline or a closely related field is required for study toward the M.S. in Heath Informatics and Analytics. Acceptable scores on the verbal, quantitative, and analytical sections of the GRE are required.

GRE Waiver

The GRE requirement may be waived for applicants who meet one of the following:

- Hold a terminal degree (e.g., J.D., M.D., D.D.S., or Ph.D.)
- Have a cumulative undergraduate or graduate GPA of 3.0 and above from a college or university accredited by an accepted accredited body
- Have successfully completed a minimum of two of the required courses in the Graduate Certificate in Health Informatics and Analytics with a GPA of 3.5 or above, and a letter of recommendation from at least one of the HIA course instructors

Waiver must be requested from the HIA Graduate Program Director when submitting the completed application. All waivers are at the discretion of the HIA Graduate Program Director. Applicants satisfying one of the above criteria may be asked by the HIA Graduate Program Director to report GRE scores.

Early Entry Program

Exceptional undergraduate students at UNC Charlotte may apply for the Early Entry Program and begin work toward the graduate degree before completion of the baccalaureate degree. See the *Undergraduate Catalog* for details and requirements. Also see the "Degree Requirements and Academic Policies" section of the *Graduate Catalog* for more information about Early Entry Programs.

Degree Requirements

The M.S. in Health Informatics and Analytics program requires 36 graduate credit hours, including 6 credit hours of Foundational Core courses, 12 credit hours of Core courses, 9 hours of Selective courses, 6 credit hours of Restricted Elective courses, and 3 credit hours of a Culminating Experience that can be satisfied by either an Internship/Practicum or a Capstone course.

A maximum of 6 hours of graduate credit may be transferred. Students may apply all of the credits earned in the Graduate Certificate in Health Informatics and Analytics towards the M.S. in Health Informatics and Analytics.

The M.S. courses that also serve the Graduate Certificate in Health Informatics and Analytics program are available via online delivery as well as face-to-face formats, meaning much (but not all) of the M.S. program is available in an online format.

Applicants lacking a college-level statistics course within 5 years of matriculation may be required to take HADM 6108 (Decision Analysis) or a comparable course upon entering the program. This course would not count toward degree requirements.

By the end of the first semester of matriculation in the program, students must complete (or be excused from based upon prior training and/or experience) non-credit asynchronous training modules in computer vocabularies, programming systems, health vocabularies, and classification systems.

Upon entering into the HIA program, students shall choose in consultation with the Program Director one of the two concentrations, the Health Services Outcomes (HSO) Concentration or the Data Science (DS) Concentration, based on their prior training and experience. These concentrations are designed to provide guidance for course selection and career planning. The HSO Concentration is most suitable for students with a health-related background, while the DS Concentration assumes more background in computing and statistics. Each concentration has its own selection of Foundational Core, Core, and Selective courses. They share the same broad selection of Restrictive Elective courses.

Students who choose the Data Science Concentration should have current working knowledge of at least one high-level programming language (e.g., Python, Java, R, or C/C++/C#); and a familiarity with computer systems and applications. A minimal background in mathematics, including two semesters of calculus and one semester of statistics, are recommended. One course in linear algebra is also highly desirable.

Health Services Outcomes Concentration

Foundational Core Courses (6 credit hours)

Within the first year of matriculation into the program, students must complete these foundational core requirements. The Graduate Program Director may approve substituting HCIP electives for either or both of these classes in cases where the student demonstrates having successfully completed comparable undergraduate and/or graduate coursework.

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HCIP 5376 - Introduction to Programming for Health Informatics (3)

Core Courses (12 credit hours)

HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6160 - Database Systems for Data Scientists (3)
HCIP 6201 - Health Information Privacy and Security: Law, Ethics, and Technology (3)
HCIP 6380 - Introduction to Health Informatics (3)

Selective Core Courses (9 credit hours)

Select at least three of the following courses. Additional selections from these options are encouraged and will fulfill the restricted elective requirement described below. Do not select HCIP 6250 if the Capstone Course option is chosen as the Culminating Experience.

HCIP 5122 - Visual Analytics (3)
HCIP 6108 - Intermediate Decision Analysis in Healthcare (3)
HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)
HCIP 6392 - Enterprise Health Information Systems (3)
HCIP 6393 - Health Data Integration (3)
HCIP 6396 - Business Intelligence in Healthcare (3)

Data Science Concentration

Foundational Core Courses (6 credit hours)

Within the first year of matriculation into the program, students must complete these foundational core requirements. The Graduate Program Director may approve substituting HCIP electives for either or both of these classes in cases where the student demonstrates having successfully completed comparable undergraduate and/or graduate coursework.

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HCIP 6380 - Introduction to Health Informatics (3)

Core Courses (12 credit hours)

HCIP 5122 - Visual Analytics (3)
HCIP 6156 - Applied Machine Learning (3)
HCIP 6160 - Database Systems for Data Scientists (3)
HCIP 6201 - Health Information Privacy and Security: Law,

Ethics, and Technology (3)

Selective Core Courses (9 credit hours)
Select at least three of the following courses. Additional selections from these options are encouraged and will fulfill the restricted elective requirement described below. Do not select HCIP 6250 if the Capstone Course option is chosen as the Culminating Experience.

DSBA 6165 - Artificial Intelligence and Deep Learning (3)
DSBA 6345 - Modern Data Science Systems (3)
HCIP 6108 - Intermediate Decision Analysis in Healthcare (3)
HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)
HCIP 6392 - Enterprise Health Information Systems (3)
HCIP 6393 - Health Data Integration (3)

Restricted Elective Courses (6 credit hours)
Select and complete 6 additional credit hours in other HCIP, HADM, DSBA, ITCS, and ITIS course offerings. The Graduate Program Director may approve substituting demonstrably relevant non-HCIP offerings to fulfill all or part of this requirement.

Culminating Experience (3 credit hours)
All students must complete a Culminating Experience in this program. Students may select one of the following courses to satisfy this requirement.

The Internship Project course may be taken after students have completed a minimum of 12 credit hours in the degree program, including HADM 6100 and HCIP 6380.

The Capstone course is normally taken in the final semester, all students complete this capstone course that engages them in a mentored real world informatics and analytics project.

To register for either Culminating Experience course, students must secure permission from the course instructor or the Graduate Program Director.

HCIP 6250 - Capstone: Problem-Solving in Healthcare Analytics (3)
HCIP 6400 - Health Informatics and Analytics Internship Project (3)

Degree Total = 36 Credit Hours

Graduate Certificate in Health Informatics and Analytics

The Graduate Certificate in Health Informatics and Analytics (HIA) is designed to introduce individuals to the core concepts of data management and analysis in healthcare. The certificate requires 15 credit hours of coursework and demonstration of competence through several non-credit activities. Courses leading to the Graduate Certificate in Health Informatics and Analytics are delivered in both face-to-face and online formats; thus, it is possible to complete the program fully online, fully in class, or mixed formats.

The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte. This Graduate Certificate represents the first part of the Professional Science Master's program in Health Informatics and Analytics (HIA PSM); thus, allowing students who want to continue their studies a smooth transition into the HIA PSM. Students may apply all of the credits earned in the HIA certificate towards the M.S. in Health Informatics and Analytics degree.

Students transitioning to other master's programs at UNC Charlotte should contact that program's director to determine which and how many courses might be applicable to that program. Students concurrently pursuing another degree can double count a maximum of 9 credit hours toward both this certificate and the other degree. However, transfer credit cannot be applied to this certificate program.

Admission Requirements
Applicants must meet the general Graduate School requirements for admission to Graduate Certificate programs. Applications must include all of the materials listed by the Graduate School as typical for Graduate Certificate application submissions. In addition to the general requirements for admission to the Graduate School, an earned baccalaureate degree from a college or university accredited by an accepted accrediting body in computer sciences, health sciences, information systems, or life sciences or in an informatics discipline or a closely related field is required for study toward the Graduate Certificate in Health Informatics and Analytics.

Certificate Requirements
The Graduate Certificate in Health Informatics and Analytics program requires 15 graduate credit hours. By the end of the first semester of matriculation in the program, students must complete (or be excused from based upon prior training and/or experience) non-credit asynchronous training modules in computer vocabularies, programming systems, health vocabularies, and classification systems.

Foundational Core Courses (6 credit hours)
Within the first year of matriculation into the program, students must complete these foundational core requirements. The Graduate Program Director may approve substituting another HCIP course for either or

both of these classes in cases where the student demonstrates having successfully completed comparable undergraduate and/or graduate coursework.

HADM 6100 - Introduction to the U.S. Healthcare System (3)
HCIP 5376 - Introduction to Programming for Health Informatics (3)

Core Courses (9 credit hours)
HCIP 6102 - Healthcare Data Analysis (3)
HCIP 6160 - Database Systems for Data Scientists (3)
HCIP 6380 - Introduction to Health Informatics (3)

Certificate Total = 15 Credit Hours

Course Descriptions

Graduate Course descriptions provide the following information:

- Subject prefix
- Course number
- Course title
- Credit hours assigned to the course
- Any course with which the course may be cross-listed
- Brief description of the course content
- If a course is graded as Pass/Unsatisfactory rather than with a letter grade
- Any restrictions on the number of times a course may be repeated
- Prerequisites and/or corequisites (if any

For example:
SUBJ 6234. Title of Course. (Credit Hours) Pre/corequisites. Brief description of course content.

Course Prefix

Courses offered for academic credit are listed by number within each subject and the **subjects are listed alphabetically according to prefixes** which are assigned as listed in the following columns.

PREFIX	SUBJECT
ACCT	Accounting
ADMN	Educational Leadership/School Administration
AFRS	Africana Studies
ARCH	Architecture
ARTE	Art Education
ATRN	Athletic Training
BDBA	Business Administration DBA
BINF	Bioinformatics
BIOL	Biology
BPHD	Business Administration Ph.D.
CEGR	Civil and Environmental Engineering
CHEM	Chemistry
CHFD	Child and Family Development
CJUS	Criminal Justice and Criminology

PREFIX	SUBJECT
CMET	Construction and Facilities Management
COMM	Communication Studies
CSLG	Counseling
CUSU	Curriculum and Supervision
DSBA	Data Science and Business Analytics
ECGR	Electrical and Computer Engineering
ECON	Economics
EDCI	Education: Curriculum and Instruction
EDUC	Education
ELDT	Education: Learning, Design, and Technology
ELED	Elementary Education
EMGT	Engineering Management
ENER	Energy and Electromechanical Systems
ENGL	English

PREFIX	SUBJECT
ENGR	Engineering
ESCI	Earth Sciences
ETGR	Engineering Technology
FINN	Finance
FLED	Foreign Language Education
FREN	French
GEOG	Geography
GEOL	Geology
GERM	German
GRAD	Graduate Life and Learning
GRNT	Gerontology
HADM	Health Administration
HCIP	Health Informatics and Analytics
HIST	History
HLTH	Public Health
HPSY	Health Psychology
HSRD	Health Services Research
INES	Infrastructure and Environmental Systems
INFO	Business Information Systems
INTE	Interpreting
ITCS	Computer Science
ITIS	Software and Information Systems
ITSC	Computing and Information Systems
KNES	Kinesiology
LACS	Languages and Culture Studies
LTAM	Latin American Studies
MALS	Liberal Studies
MAED	Mathematics Education
MATH	Mathematics
MBAD	Master of Business Administration
MDLG	Middle Grades Education
MDSK	Middle, Secondary, and K-12 Education
MEGR	Mechanical Engineering
MFPA	Fire Protection and Safety Management

PREFIX	SUBJECT
MPAD	Public Administration
MSMG	Management
MSRE	Real Estate
MUDD	Urban Design
MUPF	Music Performance
MUSC	Music
NANO	Nanoscale Science
NUAN	Nurse Anesthesia
NUDN	Nursing Practice DNP
NUMH	Nursing: Mental Health
NUNP	Nurse Practitioner
NURS	Nursing
OPER	Operations Management
OPRS	Operations Research
OPTI	Optical Science and Engineering
OSCI	Organizational Science
PHIL	Philosophy
PHYS	Physics
PPOL	Public Policy
PSYC	Psychology
READ	Reading, Language, and Literacy
RELS	Religious Studies
RESP	Respiratory Care
RSCH	Educational Research, Measurement, and Evaluation
SECD	Secondary Education
SOCY	Sociology
SOWK	Social Work
SPAN	Spanish
SPED	Special Education
STAT	Statistics
TESL	Teaching English as a Second Language
TRAN	Translating and Translation Studies
WGST	Women's and Gender Studies

Course Numbering System

Courses are identified by four-digit numbers. The first digit indicates the level of the course:

- 5000-5999 = graduate courses with parallel undergraduate courses listed at the 4000 level
- 6000-7999 = graduate certificate and master's level courses
- 8000-9999 = doctoral level courses

The following second digits designate special types of courses:

0 = topics
4 = internship, practica, clinical, and student teaching
5 = cooperative education
6 = seminars
7 = honors
8 = independent study
9 = research-based, thesis, and dissertation research

Prerequisites and Corequisites

A *prerequisite* is a requirement that must be met (or a course that must be passed) before enrolling in a more advanced course. A *corequisite* is a course which should be taken in the same semester as another.

Cross-Listed Courses

A *cross-listed course* is a single course which is simultaneously listed in the schedule of course offerings by one or more academic departments. They share the same meeting times, room, instructor(s), and curriculum. Therefore, ideally, they should also have the same course title. Students may only receive credit for the single section of the cross-listed course for which they are registered. Credit will not be awarded for a course where credit has been awarded for a cross-listed course.

Changes

Course descriptions and numbers are accurate at the time of publication of the Catalog. For the most current information, please consult with the academic department or the Class Schedule online at selfservice.charlotte.edu.

Accounting (ACCT)

ACCT 5220. Income Tax. (3) An introduction to the Federal income tax system with emphasis on concepts and procedures applicable to all types of entities.

ACCT 5311. Intermediate Financial Reporting I. (3) Prerequisite(s): ACCT 2121 or equivalent, and enrollment in the MACC program. Analysis of the financial reporting requirements of corporations with emphasis on the conceptual framework and accounting for assets.

ACCT 5312. Intermediate Financial Reporting II. (3) Prerequisite(s): ACCT 3311 or ACCT 5311 with grade of B or above; and enrollment in the MACC program. A continuation of ACCT 5311 with emphasis on financial reporting for liabilities and stockholder's equity. Also, a number of special topics, including the accounting for investments and the statement of cash flows.

ACCT 6110. Tax Research and Planning. (3) Tax research techniques applicable to federal tax law affecting individuals, corporations and partnerships, including use of traditional and computerized tax services to solve tax problems. Emphasis on tax planning principles and related tax practice matters, including handling tax compliance issues and dealing with the Internal Revenue Service.

ACCT 6120. Taxation of Corporations and Shareholders. (3) Examines the federal and state tax law applicable to corporations and their shareholders. The course covers tax compliance matters, strategies for minimizing tax liabilities and strategies for handling tax controversies.

ACCT 6130. Taxation of Pass-Through Entities. (3) Tax law applicable to partnerships, Limited Liability Companies and S corporations, including tax compliance matters strategies for minimizing tax liabilities and strategies for handling tax controversies.

ACCT 6140. Taxation of Estates, Gifts, and Trusts. (3) Wealth transfer taxes and taxation of estates and trusts, including integration of these taxes and tax planning opportunities for minimizing tax liabilities. (*Summer)*

ACCT 6150. Tax Strategy and Policy. (3) Prerequisite(s): ACCT 6120. Tax strategies in all phases of business operations, including creation of the business, choice of the type of business entity, financing, operations, distributions to owners, expansion, reorganization and liquidation with emphasis on minimizing taxes and avoiding tax traps. Analysis of business planning cases and completion of a comprehensive project with the results presented in both an oral and written report.

ACCT 6160. Advanced Individual Taxation. (3) Focuses on topics related to the taxation of individuals to enable the student to better advise taxpayers on these matters, identify problem areas and assist in tax planning matters to minimize the amount of tax due. Topics include: passive loss limitation rules, interest categorization and limitations, individual alternative minimum tax, individual net operating loss rules and rules concerning divorced taxpayers.

ACCT 6199. Topics in Taxation. (1 to 4) Topics in the area of taxation that go beyond the coverage in other existing courses by either addressing new tax issues or by delving more deeply into a tax topic. *May be repeated for credit with change in topic.*

ACCT 6220. Financial Statement Auditing. (3) Analysis of the accounting control systems and the independent auditor's examination of the system and other evidence as a basis for expressing an opinion on financial statements.

ACCT 6240. Business Environment, Governance, and Accountability. (3) Examines a wide variety of topics related to the general business environment and business concepts. Topics include: corporate governance and control, information technology, managerial and cost accounting, economic concepts and analysis, strategic planning, financial management, and operations management.

ACCT 6260. Advanced Financial Accounting I. (3) Advanced concepts and practices in financial reporting with special emphasis on the use of accounting information in capital markets and accounting theory and research. In addition, the course will examine current topics and emerging issues in financial reporting.

ACCT 6270. Accounting for Business Combinations, Governmental, and Not-for-Profit Entities. (3) Advanced concepts and practices in financial reporting with special emphasis on business combinations, consolidated financial statements and financial reporting issues and practices for governmental and other not-for-profit entities. In addition, the course examines current topics and emerging issues in financial reporting.

ACCT 6280. International Financial Reporting. (3) Examination of accounting standards under International Financial Reporting Standards (IFRS).

ACCT 6291. Financial Statement Analysis. (3) The analysis and interpretation of financial statements. This includes profitability and returns analysis, operating versus non-operating performance evaluation, credit analysis (liquidity and solvency), reformulation of financial statements, forecasting of financial statements, analysis of off-balance-sheet financing, analysis of intercorporate investments, cash flow analysis, accounting-based equity valuation,

cash-based equity valuation, market-based valuation, assessing earnings quality and earnings management, mergers and acquisitions, assessment of intangible assets, and credit ratings of debt securities.

ACCT 6299. Topics in Financial Accounting and Auditing. (1 to 4) Topics in the area of financial accounting and auditing that go beyond the coverage in other existing courses by either addressing new issues or by delving more deeply into a topic. May be repeated for credit with change in topic.

Educational Leadership/School Administration (ADMN)

ADMN 6000. Topics in Educational Administration. (1 to 6) May include classroom and/or clinic experiences in the content area. *May be repeated for credit with permission of department.*

ADMN 6100. Fundamentals of Educational Leadership. (3) The developing role of educational organizations in the United States and the societal and cultural influences that affect the delivery of schooling. Structure and organization of American schools, administrative and organizational theory, legal, moral, and ethical dimensions of schooling within the context of restructuring and reform.

ADMN 6101. Perspectives on Adult Learning Theory. (3) Cross-listed Course(s): ADMN 8101. Prerequisite(s): Graduate standing and permission of department. The examination of how adults learn in instructional settings, with the characteristics of the adult learner explored. Students investigate adult learning theory as well as current trends and advancements in adult learning. The focus is on making better instructional decisions and media selections for the education and training of adults.

ADMN 6105. Legal Aspects of Schooling. (3) Education law for education professionals which focuses on the legal rights and responsibilities of students, teachers, and administrators and how these legal provisions affect educational policy and practice.

ADMN 6106. Legal Issues in Special Education. (3) Survey of federal and state statutory and administrative provisions governing the delivery of education and related services to exceptional students.

ADMN 6107. School Law for Counselors and Related Professionals. (3) Legal issues and problems of special relevance to school counselors, psychologists, social workers, and related professionals who work with school-age children.

ADMN 6110. School Leadership and Management. (3) Examination of school leadership and administration, focusing on the role, tasks, and responsibilities that accompany school-based leadership.

ADMN 6120. Instructional Leadership. (3) Examination of research-based teaching/learning models and the relationship between instructional decisions and curriculum experiences. Dynamics of group development and problems/practices related to providing instructional assistance to teachers.

ADMN 6130. Supervision of Instruction. (3) Introduction to clinical supervision and development of skills in classroom observation, analysis, evaluation, and assistance. Systems of observation, principles of adult development in school settings, techniques for conducting classroom observations and conferences, and development of staff development programs to remedy assessed weaknesses.

ADMN 6140. Curriculum Leadership. (3) Examination of internal and external influences on curriculum formation and development at the building level with emphasis on development of administrative strategies for curriculum decision-making which are driven by staff involvement.

ADMN 6161. The Principalship. (3) Examination of school administration focusing on the role, task and responsibilities associated with the principalship with special attention to the conceptual, human and technical skills associated with the principal.

ADMN 6166. Educational Leadership. (3) Examination of leadership in formal organizations and social and behavioral science research concerning leadership ability with emphasis on educational organizations and the role of the leader in the accomplishment of organizational goals.

ADMN 6170. Introduction to the Community College. (3) Cross-listed Course(s): ADMN 8170. An overview of the two-year college with an emphasis on the comprehensive community college. Content focuses on the history and evolution of the community college including origin, culture, mission, structure, and governance. Special attention is paid to effective leadership and administration, finances, faculty, curriculum and instruction, student services and access, institutional effectiveness, community education, and economic development.

ADMN 6171. The American College Student. (3) Cross-listed Course(s): ADMN 8171. Prerequisite(s): Graduate standing and permission of department. An examination of issues related to the contemporary American college student. Topics include: a review of college student development theory, particularly related to identity and

intellectual development, approaches to college student engagement, measures for student success, the social identity of college students, and differences among students from various higher education settings.

ADMN 6172. Higher Education in the United States. (3) Cross-listed Course(s): ADMN 8172. Prerequisite(s): Graduate standing and permission of department. A review of the development of American higher education utilizing historical perspectives and relating them to the contemporary system. Topics include: college students, faculty, curriculum, governance, finance, and the context that informs change in American post-secondary education.

ADMN 6173. Legal Issues in Higher Education. (3) Cross-listed Course(s): ADMN 8173. Prerequisite(s): Graduate standing and permission of department. Examination of the legal context of American higher education and current legal issues of importance to higher education leaders, including legal requirements, legal rights, and legal allowances.

ADMN 6174. Higher Education Finance and Budgeting. (3) Cross-listed Course(s): ADMN 8174. Prerequisite(s): Graduate standing and permission of department. Examination of issues at the center of contemporary discussions of higher education finance and the challenges facing the financing of higher education. Topics include: the economic environment of higher education, tuition and affordability, regulations and compliance, budgets, and policy implications.

ADMN 6175. Non-Traditional Approaches to Higher Education. (3) Cross-listed Course(s): ADMN 8175. Prerequisite(s): Graduate standing and permission of department. Addresses new approaches to higher education that vary from the traditional higher education model. Examples include: online, for-profit, competency-based credit, corporate educational institutions, and satellite campuses in other states and countries. Access, funding, cost, quality, size, performance, and future directions of these non-traditional approaches are examined.

ADMN 6176. Women in Higher Education. (3) Cross-listed Course(s): ADMN 8176. Prerequisite(s): Master's standing and permission of the Department of Educational Leadership. An overview of the history, current research, and present condition of women students, faculty, administrators, staff, and leaders in higher education institutions in the United States. Includes an exploration of why and how women and men experience higher education differently, drawing on historical, cultural, social and theoretical contexts.

ADMN 6177. Student Affairs in Higher Education. (3) Cross-listed Course(s): ADMN 8177. An introduction to the student affairs profession within United States higher education. The primary topics include: history and development of student affairs, professional and institutional contexts, theoretical bases for the profession, organization of student affairs and functional units, essential competencies for student affairs educators, and contemporary issues affecting student affairs educators and college students.

ADMN 6178. Higher Education Policy and Governance. (3) Cross-listed Course(s): ADMN 8178. Examines a range of policy issues and governance issues regarding higher education.

ADMN 6179. Contemporary Issues in Higher Education. (3) Cross-listed Course(s): ADMN 8179. Examines a wide range of issues that are at the center of contemporary discussions of higher education.

ADMN 6180. Teaching Strategies for Adults in a Diverse Society. (3) Cross-listed Course(s): ADMN 8180. Prerequisite(s): Graduate standing and permission of department. Explores the practice of teaching adults in its complexity and variety. It is a study of methods and techniques employed in facilitating adult learning as well as an in-depth concentration of the role of philosophical orientation on teaching. Emphasis is placed on the process of designing and delivering effective individual and group learning experiences for adult learners, applying methods to learning objectives, the examining the role of the educators and their philosophies and the influence of context on the teaching of adults.

ADMN 6410. Internship and Seminar Part I. (1 to 9) An academic year internship in educational administration designed to allow theoretical and course-based practical learning to be translated and interwoven into a supervised field-based experience.

ADMN 6420. Internship and Seminar Part II. (1 to 9) A continuation of the internship experiences and seminar begun in ADMN 6410.

ADMN 6430. Internship and Professional Development in Higher Education. (3) Prerequisite(s): Enrollment in M.Ed. in Educational Leadership. Intended for master's students studying higher education as a complement to their concurrent participation in an internship in a supervised field setting.

ADMN 6490. Internship and Seminar: Administration. (3 to 6) Prerequisite(s): Permission of department. Internship under the supervision of University and on-site personnel in a setting consistent with the student's professional goals in which the student will be involved in the diverse

activities expected of the professional administrator. Seminars are held concurrently.

ADMN 6491. Internship and Seminar: Supervision. (3 to 6) Prerequisite(s): Permission of the department. Internship under the supervision of University and on-site personnel in a setting consistent with the student's professional goals in which the student is involved in the diverse activities expected of the curriculum-instructional specialist. Seminars are held concurrently.

ADMN 6601. Seminar in Administration and Supervision. (1 to 3) Prerequisite(s): Permission of the department. Examination of selected areas of interest in educational administration and supervision. *May be repeated for credit.*

ADMN 6800. Individual Study in Educational Administration. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

ADMN 8000. Topics in Educational Leadership. (1 to 6) Major topics in educational leadership. *May be repeated for credit with change of topic and permission of department.*

ADMN 8101. Perspectives on Adult Learning Theory. (3) Cross-listed Course(s): ADMN 6101. The examination of how adults learn in instructional settings, with the characteristics of the adult learner explored. Students investigate adult learning theory as well as current trends and advancements in adult learning. The focus is on making better instructional decisions and media selections for the education and training of adults.

ADMN 8110. Organizational Theory and Behavior. (3) Prerequisite(s): Admission to Ed.D. in Educational Leadership. Analysis of the structure and organization of public education in the United States in terms of organizational theory and historical development. Consideration of organizational change theory, organizational development, and the planning process.

ADMN 8120. Rethinking Education Reform: Law, Policy, and Public Schools. (3) Prerequisite(s): Admission to Ed.D. in Educational Leadership program or permission of instructor. Introduction to the elements of in-depth legal analysis, research, and writing of selected educational issues.

ADMN 8121. Doctoral Seminar in Curriculum Design. (3) Examination of principles and practices for educational leaders in program design, implementation and evaluation.

ADMN 8122. Advanced Curriculum Theory and Development. (3) An examination of philosophic thought and its relationship to educational theories which have led to assumptions for educational practices in American schools.

ADMN 8125. Doctoral Seminar in Instruction. (3) Analysis of models of teaching and the match between attributes of the models and the instructional outcomes desired by the teacher.

ADMN 8130. Educational Governance and Policy Studies. (3) Prerequisite(s): Admission to Ed.D. program in Educational Leadership. An examination of the institutional structure for policy-making in American education and the theories, models and practices that relate to policy-making in education.

ADMN 8140. School Finance. (3) Prerequisite(s): Admission to Ed.D. in Educational Leadership or permission of instructor. An examination of the theory and operation of public school finance systems and school business administration with special attention to local, state, and federal sources of revenue and such business functions as budgeting and financing capital outlay projects.

ADMN 8150. Human Resources Development and Administration. (3) Prerequisite(s): ADMN 8110 or initial licensure as school administrator. Examination of personnel administration in educational institutions, including administration of personnel at the school district level and its contribution to the overall management and operation of a school system.

ADMN 8160. Introduction to Educational Administration. (3) Examination of behavioral components of administrative theory, organization, decision-making and planning for educational development including appraisal of significant functions, techniques, practices and problems as they relate to public school systems, social institutions, and the system of social and governmental agencies.

ADMN 8170. Introduction to the Community College. (3) Cross-listed Course(s): ADMN 6170. Prerequisite(s): Admission to a doctoral program and permission of advisor and instructor. An overview of the two-year college with an emphasis on the comprehensive community college. Content focuses on the history and evolution of the community college including origin, culture, mission, structure, and governance. Special attention is paid to effective leadership and administration, finances, faculty, curriculum and instruction, student services and access, institutional effectiveness, community education, and economic development.

ADMN 8171. The American College Student. (3) Cross-listed Course(s): ADMN 6171. Prerequisite(s): Doctoral

standing and permission of department. An examination of issues related to the contemporary American college student. Topics include: a review of college student development theory, particularly related to identity and intellectual development, approaches to college student engagement, measures for student success, the social identity of college students, and differences among students from various higher education settings.

ADMN 8172. Higher Education in the United States. (3) Cross-listed Course(s): ADMN 6172. A review of the development of American higher education utilizing historical perspectives and relating them to the contemporary system. Topics include: college students, faculty, curriculum, governance, finance, and the context that informs change in American post-secondary education.

ADMN 8173. Legal Issues in Higher Education. (3) Cross-listed Course(s): ADMN 6173. Prerequisite(s): Doctoral standing and permission of department. Examination of the legal context of American higher education and current legal issues of importance to higher education leaders, including legal requirements, legal rights, and legal allowances.

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ADMN 8175. Non-Traditional Approaches to Higher Education. (3) Cross-listed Course(s): ADMN 6175. Prerequisite(s): Doctoral standing and permission of department. Addresses new approaches to higher education that vary from the traditional higher education model. Examples include: online, for-profit, competency-based credit, corporate educational institutions, and satellite campuses in other states and countries. Access, funding, cost, quality, size, performance, and future directions of these non-traditional approaches are examined.

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ADMN 8177. Student Affairs in Higher Education. (3) Cross-listed Course(s): ADMN 6177. An introduction to the student affairs profession within United States higher education. The primary topics include: history and development of student affairs, professional and institutional contexts, theoretical bases for the profession, organization of student affairs and functional units, essential competencies for student affairs educators, and contemporary issues affecting student affairs educators and college students.

ADMN 8178. Higher Education Policy and Governance. (3) Cross-listed Course(s): ADMN 6178. Examines a range of policy issues and governance issues regarding higher education.

ADMN 8179. Contemporary Issues in Higher Education. (3) Cross-listed Course(s): ADMN 6179. Examines a wide range of issues that are at the center of contemporary discussions of higher education.

ADMN 8180. Teaching Strategies for Adults in a Diverse Society. (3) Cross-listed Course(s): ADMN 6180. Prerequisite(s): Doctoral standing and permission of department. Explores the practice of teaching adults in its complexity and variety. It is a study of methods and techniques employed in facilitating adult learning as well as an in-depth concentration of the role of philosophical orientation on teaching. Emphasis is placed on the process of designing and delivering effective individual and group learning experiences for adult learners, applying methods to learning objectives, the examining the role of the educators and their philosophies and the influence of context on the teaching of adults.

ADMN 8181. Equity and Social Justice in Adult Education. (3) Engages learners in critical thought and discussion around issues of equity, social justice, and adult education. Through exploration of concepts such as oppression, discrimination, power, privilege, and hegemony, learners develop an understanding of how markers of difference (e.g., race, gender, class, sexual orientation, etc.) impact one's sense of fairness, pedagogy, and practice. A core aim of the course is to assist learners in understanding how equity and social justice impact adult education. Through gaining an appreciation for the theoretical underpinnings of social justice education and the manifestations of oppression that necessitated its development, learners develop a sensitivity to adult education as a collaborative endeavor that takes into account the person, the environment (both macro and micro), and the adult educator.

ADMN 8410. Advanced Internship in Educational Leadership Part I. (3) Prerequisite(s): ADMN 8110, ADMN 8120, ADMN 8130, and ADMN 8140. Internship

experiences planned and guided cooperatively by University and school personnel, including some work in private, community, or social service organizations. Accompanying cohort seminar for integrating and synthesizing knowledge and skills useful to practicing school leaders.

ADMN 8420. Advanced Internship in Educational Leadership Part II. (3) Prerequisite(s): ADMN 8410. Continuation of ADMN 8410.

ADMN 8439. Practicum in Adult Education. (3) Prerequisite(s): ADMN 8101, admission to the doctoral program, and permission of the advisor and instructor. Explore and expand an identified area of adult education that builds on professional and/or academic experiences previously engaged in or studied. Includes a variety of activities and experiences developed by the student in consultation with the instructor. These enable students to extend skills or develop new competencies as they work with adults in selected contexts in the community. *May be repeated for credit two times.*

ADMN 8489. Practicum in Staff Development. (3) Examination of techniques of delivering in-service training and development of leadership for in-service educational programs including design and implementation of a staff development program in a school setting.

ADMN 8610. Interdisciplinary Seminar. (3) Prerequisite(s): Admission to Ed.D. in Educational Leadership. Ideas, values, cultures, and contemporary issues affecting society generally and education particularly and principles and practices for responding to the public with whom school leaders interact. *May be repeated for credit.*

ADMN 8660. Instructional Leadership Seminar. (3) Investigation and evaluation of current trends and issues in instruction as they relate to the role of the educational leader, with special attention to the role of facilitating the teaching/learning process.

ADMN 8695. Advanced Seminar in Teaching and Learning. (3) Examination of a number of current teaching models to provide a framework for choosing those appropriate for a given classroom setting with special attention to the relationship between teaching strategies and learning outcomes.

ADMN 8699. Dissertation Proposal Seminar. (3) Prerequisite(s): Completion of research requirements. Identification and definition of a research area and development of a proposal draft for an original research study appropriate for the dissertation requirement.

ADMN 8800. Individual Study in Educational Administration. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

ADMN 8999. Dissertation Research. (3) Prerequisite(s): Permission of Ed.D. Program Director. Execution of original research study that addresses the solution to an educational or school-related problem or that addresses a substantive educational leadership or programmatic issue. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Africana Studies (AFRS)

AFRS 5000. Special Topics in Africana Studies. (3) Intensive survey of a topic in African, African American, or the broad African Diaspora studies, depending on the needs of student and staff resources. *May be repeated for credit with change of topic.*

AFRS 6610. Diaspora and Transnational Theories. (3) Focuses on the dialectical relationships between the social theories of nation, state, ethnicity, identity, race, and culture on one hand and the emerging theorizing of the diaspora and transnational networks on the other. The historical contexts that have shaped the African Diaspora and the more recent global transnational networks will be emphasized throughout the course.

AFRS 6620. Advanced Readings in African Modernities. (3) Prerequisite(s): 3 credit hours of Africana Studies course(s) at the graduate-level or approval of the Graduate Program Director. The advanced seminar explores the meanings, character, complexity, and consequences of modernity in Africa. The interdisciplinary readings and the analyses that derive from a wide range of disciplines – philosophy, history, anthropology, politics, literature, and the arts - will be deployed to understand the African realities of modernity as a product of 500 years of history from the Atlantic Slavery through colonialism, to the present.

AFRS 6630. Graduate Colloquium. (3) Prerequisite(s): prior written permission of instructor and Graduate Program Director. Focuses on an interdisciplinary theme that combines two or more of the following: literature, language, politics, health issues, social policy, education, popular culture, history, performance theory, pedagogy, etc. Students write short papers and reports directed toward developing breadth in the theoretical and empirical understanding of a topic in Africana Studies using interdisciplinary approaches. *May be repeated for credit with change of topic.*

AFRS 6901. Directed Readings/Research. (3) Prerequisite(s): prior written permission of instructor and Graduate Program Director. A directed research on a specific

theme in Africana Studies. Students will produce a publishable essay at the end of the semester based on original research. The goal is for students to develop research, theoretical and analytical depth in an area of study in Africana Studies. *May be repeated for credit with change of topic.*

Anthropology (ANTH)

ANTH 5020. Topics in Cultural Anthropology.(3) Prerequisite(s): Permission of instructor. Specialized topics in Cultural Anthropology. Examples include: Field Methods in Medical Anthropology; Semiotics and Culture. *May be repeated for credit with change of topic.*

ANTH 5040. Topics in Biological Anthropology. (3) Prerequisite(s): Permission of instructor. Specialized topics in Biological Anthropology. Examples include: Chromosomal Evolution in the Chimpanzees; Ecologies of Southeast Asian Primates. *May be repeated for credit with change in topic.*

ANTH 5050. Topics in Archaeology. (3) Prerequisite(s): Permission of instructor. Specialized topics in Archaeology. Examples include: Radiometric Dating Techniques; Early State Expansion in the Andes. *May be repeated for credit with change of topic.*

ANTH 5090. Topics in Anthropology. (3) Prerequisite(s): Permission of instructor. Intensive treatment of a topic in anthropology or survey of related topics. Examples: Religion, Art, and Archaeology; Islam and Globalism. *May be repeated for credit with change of topic.*

ANTH 5120. Intercultural Communications. (3) Prerequisite(s): ANTH 1101 or permission of instructor. Learning to cope with cultural differences; contrasting value systems; cross-cultural communication styles; nonverbal communication; cultural relativity; culture and business; ethnocentrism; cultural shock.

ANTH 5122. Ethnographic Methods. (3) Designed to introduce students to the methodological approaches used in ethnography and to provide a basic mastery of several key methods used in ethnographic research. Includes a discussion of the nature of inquiry in the social sciences; the development and implementation of different kinds of research designs to investigate a range of questions; issues of sampling and informant selection; research ethics; participant observation, interviewing techniques; data management and analysis.

ANTH 5131. Culture, Pregnancy, and Birth. (3) Cross-listed Course(s): WGST 5131. Explores how culture shapes the experience and practice of pregnancy and birth. Some of the topics explored include the birthing experience, midwifery, infertility, new reproductive technologies, and surrogate motherhood.

ANTH 5140. Field Biology of the Primates. (3) The theory and methods utilized in the study of nonhuman primate behavior. This applied behavioral primatology course entails original research projects done at an appropriate zoological venue in North and South Carolina.

ANTH 5453. Field Project in Archaeology. (1 to 4) Prerequisite(s): Permission of instructor. Practical experience in archaeological techniques. Students participate in field research on an historic or prehistoric archaeological site. Research may include field reconnaissance, excavation, mapping, systematic description and analysis of cultural material, and/or other techniques appropriate to the site and research problem. Students supervise undergraduates under the guidance of the instructor. *May be repeated for credit with up to 6 credits applied to the M.A. degree.*

ANTH 5615. Seminar in Middle East Ethnography. (3) Seminar exploring both historically significant and recent ethnographies on selected topics. Examples include Israel/Palestine, Women in the Middle East, and Tribe, State, and Nation in the Middle East. *May be repeated for credit with change of topic.*

ANTH 5622. Seminar in the Ethnography of Religion. (3) Seminar exploring both historically significant and recent ethnographies on the anthropology of religion.

ANTH 5641. Bioarchaeology Methods. (3) Introduction to methods that bioarchaeologists use to learn about people's lives and deaths from human skeletal remains. Includes reading bioarchaeological and forensic case studies and research articles, and applying this knowledge to investigate cases in the University's forensic collection. By the end of the course, students are able to analyze a skeleton for demographic characteristics, paleopathology, trauma, and other cultural identifiers. They are additionally able to read and interpret bioarchaeological articles and critique the methods, interpretations, and conclusions.

ANTH 6010. Advanced Topics in Cultural Anthropology/Linguistics. (3) Prerequisite(s): Permission of the department. Intensive treatment of a topic in cultural anthropology or linguistic anthropology, depending on student needs and faculty resources. *May be repeated for credit.*

ANTH 6040. Advanced Topics in Biological Anthropology. (3) Prerequisite(s): Permission of the department. Intensive treatment of a topic in biological anthropology, depending on student needs and faculty resources. *May be repeated for credit.*

ANTH 6050. Advanced Topics in Archaeology. (3) Prerequisite(s): Permission of the department. Intensive treatment of a topic in archaeology, depending on student needs and faculty resources. *May be repeated for credit.*

ANTH 6132. Culture, Health, and Aging. (3) Exploration of the interaction between culture and the aging experience, with a particular emphasis on issues of health and the healthcare system.

ANTH 6400. Anthropology Practicum. (3) Prerequisite(s): Permission of the department. Pre- or Corequisite(s): ANTH 6611. Supervised practical experience in the application of anthropological principles in an agency, organization, or facility not part of the department. Following the needs of the agency, students will conduct applied research and write a report as part of this practicum. *May be repeated for credit; 6 credits may be applied to the M.A. degree program.*

ANTH 6401. Teaching Anthropology. (1) Methods and skills for teaching undergraduate students. Students examine and practice teaching skills and classroom procedures. Includes preparation of model teaching materials, such as syllabi, and practice teaching.

ANTH 6601. History of Anthropology. (3) Development of the field of anthropology; key concepts, focusing on concepts of "race" and "culture;" debates in anthropological method and theory; implications for ethical practice in contemporary anthropology.

ANTH 6602. Seminar in Interdisciplinary Anthropology. (3) Analysis of a key issue or debate through the lens of two or more anthropological specialties. Emphasizes the holistic, interdisciplinary nature of anthropology. *May be repeated for credit with change of topic.* Up to 6 hours may be applied to the degree.

ANTH 6603. Theory in Social and Cultural Anthropology. (3) Discussion of major works that form the theoretical foundation of contemporary social and cultural anthropology.

ANTH 6604. Issues in Archaeological Practice. (3) Exploration of current theory and practice in anthropological archaeology. Topics include: major theoretical perspectives; the relationship of theoretical choices with the formation of research problems and choice of research methods; discussion of the legal and ethical framework of contemporary archaeology; examination of the influence of multiple stakeholders on the practice of archaeology.

ANTH 6605. Evolutionary and Biological Anthropology. (3) Discussion of theories, concepts, and controversies informing biological anthropology, including evolutionary theory as applied to primate and human evolution, behavioral ecology, genetics, and modern human variation.

ANTH 6606. Language and Culture: Foundational Issues in Linguistic Anthropology. (3) Discussion of the theories, concepts, controversies, and major findings of linguistic anthropology. Includes an analysis of the difference between human and non-human communication, semiotics, language and thought, the nature of meaning, language socialization, language variation, language and power, and multilingualism, as well as linguistic change. No prior training in linguistics is assumed, presupposed, or required.

ANTH 6611. Seminar in Applied Anthropology. (3) Theories, methods, and ethics of applied anthropology in medical, educational, business, and development fields. Cultural perspective on the program evaluation in community settings; culturally competent evaluations using ethnographic methods; role of anthropology in program development and evaluation at the regional, national, and international levels.

ANTH 6612. Theoretical Approaches to Gender. (3) Cross-listed Course(s): WGST 6602. An interdisciplinary examination of the core theories about the role of gender in identity formation and social organization. Topics covered include the feminist critique of biological essentialism; gender as a continuum; the social construction of gender; gender perfomativity; historical changes in gender; masculinity studies; the intersection of race, class and gender; and the economics of gender.

ANTH 6613. Seminar in Medical Anthropology. (3) A graduate seminar in medical anthropology that explores the relationship between mind, body and society. Students begin with learning about the centrality of culture and belief when studying health and illness across different cultures. Central theories and key concepts in medical anthropology are defined and critiqued, such as cultural relativism, ethnocentrism, the political economy of health, structural violence, symbolic violence, critical medical anthropology, and illness narratives. These concepts are used to examine contemporary health issues.

ANTH 6642. Selection in Relation to Sex in Primates. (3) Explores the current state of theory and empirical research on sexual selection; discussion will focus on critically evaluating the evidence that sexual selection plays an important role in the evolution and maintenance of particular aspects of morphology, behavior and social organization in nonhuman primates and humans.

ANTH 6800. Directed Readings/Research. (1 to 3) Prerequisite(s): Permission of the department. Study of specialized topic through individually designed reading

program and scheduled conferences with a faculty member. *May be repeated for credit.*

ANTH 6910. Thesis Tutorial. (3) Prerequisite(s): Permission of the Graduate Program Director. Independent study with a faculty advisor, to conduct research for the M.A. thesis.

ANTH 6920. Master's Thesis. (3) Prerequisite(s): Admission to candidacy and permission of the Graduate Program Director. Preparation of master's thesis under the supervision of the thesis committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 6 credits.*

Architecture (ARCH)

ARCH 5050. Architecture Topics. (1 to 6) Cross-listed Course(s): ARCH 4050. Architectural elective topics are available in a wide variety of subjects. Topics include: Computation, Theory, Representation, Making, Urbanism, and Technology. *May be repeated for credit up to 12 credit hours; students may enroll in duplicate sections each semester.*

ARCH 5201. Architectural History I: Prehistory-1750. (3) Global survey of architecture and urbanism from prehistory to 1750. Explores key examples of buildings and cities as well as the theoretical, environmental, political, economic, technological, and cultural context in which they were built. Provides a general knowledge of the formal, spatial and ornamental characteristics that distinguish the built environment of distinct historic and traditional building cultures.

ARCH 5202. Architectural History II: 1750-Present. (3) Prerequisite(s): ARCH 5201 or permission of instructor. Global survey of architecture and urbanism from 1750 to the present. Explores key architectural and urban ideas, designers, buildings, and urban projects as well as how they were shaped by their environmental, political, economic, technological, and cultural context.

ARCH 5203. Architectural History III: Survey of Contemporary Theory (1950-Present). (3) Prerequisite(s): ARCH 5202 or MII Standing. Survey of architecture theory from 1950 to the present. Focuses on the key ideas, texts, debates, and discourse that have informed architectural practice in the late twentieth and early twenty-first century. (*Fall*)

ARCH 5204. Architectural History Topics. (3) Cross-listed Course(s): ARCH 8004. Topics are available in a wide variety of subjects in architectural history and theory, in which students develop in-depth research, writing, and presentation skills. *May be repeated for credit with change of topic.*

ARCH 5206. Professional Practice. (3) An introduction to the objectives of the practice of architecture, its responsibilities and procedures, and emerging alternative forms of practice and as they pertain to the role of the architect.

ARCH 5301. Materials and Assembly Principles. (3) Introduces the quantitative and qualitative characteristics of architectural materials, systems, and processes. Students are introduced to the physical properties of materials relevant to their application in construction, assembly, and detail systems. Topics include: masonry, concrete, wood, steel, glass, cladding, and roofing and flooring materials and their assemblies.

ARCH 5302. Environmental Systems Principles. (3) Prerequisite(s): ARCH 5301 or permission of instructor. Introduces qualitative and quantitative analytical methods commonly used to assess the impact of environmental forces on occupant thermal and luminous comfort, energy performance, and regional sustainability. Students are introduced to the interplay between climatic events, patterns of building use, and the architectural variables that inform the appropriate application of building systems technology. Topics include: building envelope performance, and the introduction of passive and mechanical systems for heating, cooling, illuminating, and ventilating buildings.

ARCH 5303. Structural Principles. (3) Prerequisite(s): ARCH 5301 or permission of instructor. Introduces issues relevant to the fundamentals of structures including statics, strength, and stability of materials. Students will be introduced to structural concepts, systems, and the tracing of structural loads through basic principles, physical modeling, and theoretical and analytical methods. Topics include: interrelationship between strain, stress, and stability, as well as the implications of tension, compression, shear, torsion, and bending.

ARCH 5304. Structural Systems. (3) Prerequisite(s): ARCH 5303. Introduces specific structural applications of wood, steel, concrete, and masonry systems commonly used in small-scale commercial/institutional buildings. Students are introduced to the design of beams, columns, walls, joinery, and connections appropriate to each material type through theoretical, analytical, and computer simulation methods.

ARCH 5305. Building Systems Integration. (3) Prerequisite(s): ARCH 5304 or MII Standing. Introduces a set of advanced issues related to the comprehensive, systemic integration of building technology systems commonly used in large-scale buildings through case

study, analytical, and simulation methods. Topics address the resolution of building structure, materials, environmental systems, mechanical systems, electrical systems, life safety, building water supply and waste, and conveying systems in building design.

ARCH 5601. Ideas in Architecture. (3) The fundamental concepts, issues, and working knowledge specific to design in architecture. Topics include: order, form and space, site, type, and architectural meaning.

ARCH 5604. Computational Methods. (3) Prerequisite(s): ARCH 6603 or MII Standing. Corequisite(s): ARCH 7101 or permission of instructor. Introduces students to the fundamental concepts of computation through explorations with basic scripting and parametric tools. The goal is to understand the potential of computation and the role it can play as part of one's design process, not as a collection of specific tools, but as a way of thinking about design.

ARCH 5605. Computational Practice. (3) Prerequisite(s): ARCH 5604 or permission of instructor. Capstone course for digital media and computational studies in the School of Architecture. The goal of this seminar course is to provide students with experience using advanced digital tools and methods, including digital fabrication, parametrics, Building Information Modeling/Management (BIM), scripting, and performance analysis in preparation for professional practice and/or advanced graduate research.

ARCH 5606. Scripting. (3) Teaches students how to apply scripting as one might within a professional setting: understanding discipline-specific procedures and problems, planning and developing scripts, testing, debugging, and supporting scripts within a production environment. Students gain an understanding of how scripting can support professionals in their daily work by improving productivity and enabling innovation.

ARCH 5607. Digital Fabrication. (3) Cross-listed Course(s): ARCH 8607. An introduction to the use of parametric software and the use of digitally controlled fabrication. Emphasizes both the development of complex building components in modeling software and the construction of those components using laser cutter, CNC routers and plasma cutters, 3D printers, and other equipment.

ARCH 5611. Research Methods I: Computational. (3) An overview of the fundamental concepts of design computation through explorations with methods such as parametric software and scripting. Students study these methods in the context of emerging areas of architectural technology research such as Building Information Modeling (BIM), digital fabrication, building performance optimization, and generative design, among others.

ARCH 5612. Research Methods II. (3) Undertakes a historical survey of the dominant theoretical rubrics designers have used to integrate scientific concepts into architectural research since the Enlightenment. The course is divided into two parts. The first half exposes students to the range of conceptual strategies and techniques architects have used to translate scientific concepts into architectural form, from direct experimentation of structural principles to analogical and metaphorical models of procedural design strategies. The second half requires students to develop a working thesis statement of their independent research that places their work within one of the historical traditions reviewed in class.

ARCH 6050. Architectural Elective. (1 to 6) Cross-listed Course(s): ARCH 8050. Architectural Electives are available in a wide variety of subject. Topics include: Computation, Theory, Representation, Making, Urbanism, and Technology. *May be repeated for credit up to three times with change of topic.*

ARCH 6101. Design Studio: Fundamentals. (6) Corequisite(s): ARCH 6602. An introductory architectural design studio that focuses on fundamental concepts of architecture, as well as the acquisition and practice of a wide range of technical and graphic skills and media. It is intended to complement the reading and writing engaged in ARCH 5601 and to serve as an arena to explore and test the issues encountered in that course through the act of making.

ARCH 6102. Design Studio: Fundamentals. (6) Prerequisite(s): ARCH 6101. Corequisite(s): ARCH 6603. An introductory architectural design studio that focuses on the development of site, space, and design process issues, as well as the continued acquisition and practice of a variety of technical and graphic skills. Exploration into the creative and appropriate use of a variety of media is addressed.

ARCH 6103. Design Studio: Options. (6) Prerequisite(s): Enrollment in Master of Architecture in MI Concentration. Graduate studio for 3+ year M.Arch. students following the first full year of study. This intensive studio-based course allows for a variety of topical studio learning options, including: summer study travel abroad, design building activities, and other design-related projects and activities.

ARCH 6306. Technology Topic. (3) Focuses on the study of topical areas of technology in architecture. Provide an in-depth extension of the five required technology courses. The course may be selected from a number of designated technology courses that examine specific issues contributing to architecture as a process of

investigation, innovation, analysis and/or research. *May be repeated for credit with change of topic.*

ARCH 6601. Ideas in Architecture. (3) Corequisite(s): ARCH 6100. This seminar class concentrates on fundamental concepts, issues, and working knowledge specific to design in architecture. It is intended to complement the design problems encountered in ARCH 6100 (studio) and to serve as a critical platform to raise issues that are not always evident in studio making alone. Primary topics addressed include order, form and space, site, type, and architectural meaning.

ARCH 6602. Representation I: Fundamentals. (3) Prerequisite(s): ARCH 6100. Corequisite(s): ARCH 6101 or permission of instructor. A fundamental visual and architectural skills course that includes lessons in: visual composition, 2D design and communication, 3D physical models, graphic and photographic image manipulation, and craft in design. Also includes readings and criticism, which address the artistic and architectural correlation of these skills.

ARCH 6603. Representation II: Digital Fundamentals. (3) Prerequisite(s): ARCH 6602. Corequisite(s): ARCH 6102. Introduces students to architectural drafting (2D) and modeling (3D) using digital tools and processes. The expected outcome of this course is a student who is skillful, adaptable, and critical in the use of digital media.

ARCH 6890. Directed Independent Study. (1 to 6) Prerequisite(s): Permission of the Graduate Program Director and the graduate faculty member advising the study. Enables directed individual study and in-depth analysis of a special area related to the interests of the student and the expertise of the advising faculty member. May count towards completion of Concentration requirements if appropriate. *May be repeated for credit with change of topic.*

ARCH 7101. Design Studio: Topical. (6) Prerequisite(s): ARCH 6102 or MII Standing. Focuses on issues relevant to current architectural practice and/or exploration of architectural theory. Students choose from among several sections of this studio, each of which addresses a different set of issues. The issues addressed as well as the pedagogical approach of these studios are defined by the faculty teaching them. All students must take a minimum of one Topical Design Studio within their area of Concentration.

ARCH 7102. Design Studio Topics. (6) Prerequisite(s): ARCH 7101, Graduate standing, and enrollment in Architecture program. Focuses on issues relevant to current architectural practice and/or exploration of architectural theory. Students choose from among several sections of this studio, each of which addresses a different set of issues. The issues addressed as well as the pedagogical approach of these studios are defined by the faculty teaching them. All students must take a minimum of one Topical Design Studio. *May not be repeated for credit.*

ARCH 7103. Design Studio Integrated Project. (6) Prerequisite(s): Graduate standing and enrollment in Architecture program. Corequisite(s): ARCH 5305. Focuses on a site-specific project emphasizing technological and systemic issues that lead towards a comprehensive building design. This necessitates an integrative process, examining the intersection of project circumstances, formal/spatial interpretations, conceptual thinking, systemic materiality and technology, tectonic clarity, and performative strategies for architecture. *May not be repeated for credit.*

ARCH 7104. Design Studio: Diploma Project. (6) Prerequisite(s): ARCH 7103. This concluding design studio for the M.Arch. is the capstone project experience for the professional degree. Students engage an instructor-led studio theme that involves design, research, and/or practical issues relevant to architecture and its discourse.

ARCH 7201. Design Methodologies. (3) Focuses on examination of analytic and synthetic models including information processing, programming, and implementation activities used to structure the architect's design process, conjectural models, and methods specific to the architect's creative skills.

ARCH 7210. Thesis Prep. (3) This course is taken in the semester before thesis and serves as a guided independent research seminar in which students conduct literature reviews, test ideas, and prepare for their thesis.

ARCH 7211. Studio Lab I. (4 to 6) Cross-listed Course(s): ITCS 6211, ITIS 6211, and ARCH 8211. The Studio/Lab sequence situates students with varying backgrounds in an educational and research environment that allows them to develop and test innovative design tools, applications and settings. Each semester may be jointly taught by faculty from the School of Architecture and the College of Computing and Informatics and/or other collaborating departments from the University. Each semester, the course is organized around research questions, projects, and/or topics chosen by the participating faculty.

ARCH 7212. Studio Lab II. (4 to 6) Cross-listed Course(s): ITCS 6212 and ITIS 6212. The Studio/Lab sequence situates students with varying backgrounds in an educational and research environment that allows them to develop and test innovative design tools, applications, and settings. Each semester may be jointly taught by faculty from the School of Architecture and the College of Computing and Informatics and/or other collaborating departments from

the University. Each semester is organized around research questions, projects and/or topics chosen by the participating faculty.

ARCH 7213. Thesis. (6) Cross-listed Course(s): ITCS 6991 and ITIS 6991. The Thesis is the culmination of the student's work in the Dual Degree Program. It allows students to pursue focused research based upon their previous experiences and coursework. The intent is to demonstrate an understanding of an ongoing discourse, to form a clear hypothesis and to develop research methods suitable to implement and test the hypothesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

ARCH 7500. Architectural COOP: Integrated Path to Architectural Licensure (iPAL). (0) Prerequisite(s): Enrollment in the iPAL Program. This course is an intensive sixteen-month experience that offers students enrolled in the Integrated Path to Architectural Licensure Program (iPAL) placement in a professional architectural office in order to accrue Architectural Experience Program (AXP) credits to sit for the Architectural Registration Examination (ARE) as part of their architectural license process prior to graduation from an accredited academic program. This required experience should be taken in the year prior to their final year in the academic program. The course is overseen by faculty and professional office advisors, and operates under cooperative education requirements of the University Career Center. *Graded on a Pass/Unsatisfactory basis. May be repeated.*

ARCH 7950. Directed Research Study. (3) Prerequisite(s): completion of first year of the M.Arch. II Program (or equal). An optional opportunity for research in which M.Arch. II students may engage. Allows graduate students to engage research activities to support their growing knowledge of architecture and architectural discourse. Informs and motivates possible interests that the students might pursue in their final year of study.

ARCH 8004. Architectural History Topics. (3) Cross-listed Course(s): ARCH 5204. Prerequisite(s): Graduate standing. Topics are available in a wide variety of subjects in architectural history and theory, in which students develop in-depth research, writing, and presentation skills. *May be repeated for credit with change of topic.*

ARCH 8050. Architectural Elective: Connective Environments I. (3) Cross-listed Course(s): ARCH 6050. Topics include: Computation, Theory, Representation, Making, Urbanism, and Technology. *May be repeated for credit with change of topic.*

ARCH 8211. Studio Lab. (4) Cross-listed Course(s): ARCH 7211. A studio approach to teaching topics in interaction design. Aspects of interaction design taught in the studio may include: gesture-based interaction, tangible interaction, large public display interaction, tabletop interaction, multi-touch tablet interaction, and human-robot interaction. *May be repeated with permission of Graduate Program Director.*

ARCH 8607. Digital Manufacturing and Robotics. (3) Cross-listed Course(s): ARCH 5607. The use of digital manufacturing and robotics is quickly becoming an engrained part of design professions. The understanding of how these machines function will become an essential component of an Architect's understanding of how buildings can be manufactured both in-situ and in a factory. *May be repeated for credit with permission of Graduate Program Director.*

Art Education (ARTE)

ARTE 5121. Teaching Art to Elementary Students. (3) Prerequisite(s): Admission into Graduate Certificate in Teaching Art Education. Analysis of learning themes as related to growth and development in the visual arts; organization of tools, media and materials appropriate for the elementary level; curriculum design in planning art units and lessons, evaluation and motivation techniques. A practicum of minimum 20 hours in an elementary setting is required where the student assists the teacher, tutors students, and practices teaching a minimum of two times.

ARTE 5122. Teaching Art to Secondary Students. (3) Prerequisite(s): Admission into Graduate Certificate in Teaching Art Education. Analysis of learning themes as related to growth and development in the visual arts; organization of tools, media and materials appropriate for the middle/secondary level; curriculum design in planning art units and lessons, assessment, classroom management and motivation techniques. A practicum of minimum 20 hours in a secondary setting is required where the student assists the teacher, tutor students, and practices teaching a minimum of two times.

Athletic Training (ATRN)

ATRN 6100. Acute and Emergency Care in Athletic Healthcare. (3) Prerequisite(s): Admission to MSAT program and current certification in either American Red Cross Professional Rescuer CPR or American Heart Association Basic Life Support for Healthcare Providers. A comprehensive approach to acute and emergency care in athletic healthcare through lecture and laboratory activities in identification of risk factors, preparation of emergency plans, and recognition of emergency medical conditions.

ATRN 6101. Clinical Anatomy for Allied Health. (3) Prerequisite(s): Admission to MSAT program. An

advanced examination of musculoskeletal anatomy and how it relates to function of the human body.

ATRN 6102. Fundamentals in Athletic Training. (3) Prerequisite(s): Admission to MSAT program. An overview of athletic training, including basic components of the athletic training profession. Topics include: taping procedures, appropriate terminology, and documentation and communication methods.

ATRN 6104. Clinical Evaluation and Diagnosis of the Lower Extremity. (3) Prerequisite(s): ATRN 6101 and ATRN 6102. A comprehensive approach to the assessment and diagnosis of lower extremity musculoskeletal injuries, including the identification of risk factors, the role of clinical outcome measures, and appropriate referral decisions.

ATRN 6105. Therapeutic Modalities. (3) Prerequisite(s): ATRN 6101 and ATRN 6102. Provides both theoretical and clinical bases for the use of therapeutic modalities and pharmacology in the rehabilitation setting. Topics include: basic physics, physiological effects, indications, contraindications, and applications of therapeutic modalities in rehabilitation.

ATRN 6106. Therapeutic Exercise Techniques. (3) Prerequisite(s): ATRN 6101 and ATRN 6102. Study of the theory and principles that guide the application of therapeutic exercise. Emphasis is placed on understanding the tissue healing response, and the basic elements of a rehabilitation program.

ATRN 6107. Foundations of Modern Healthcare. (3) Develops essential skills for evidence-based practitioners in healthcare. Students learn how to generate clinical questions; interpret access, evaluate, and integrate relevant research literature. Students also use their own clinical experiences with patient-orientated outcomes measures along with research to make clinical decisions.

ATRN 6109. Clinical Evaluation and Diagnosis of the Upper Extremity. (3) Prerequisite(s): ATRN 6104. A comprehensive approach to the assessment and diagnosis of upper extremity musculoskeletal injuries, including the identification of risk factors, the role of clinical outcome measures, and appropriate referral decisions.

ATRN 6110. Clinical Evaluation and Diagnosis of the Head and Spine. (3) Prerequisite(s): ATRN 6104. A comprehensive approach to the assessment and diagnosis of upper extremity musculoskeletal injuries, including the identification of risk factors, the role of clinical outcome measures, and appropriate referral decisions.

ATRN 6111. Therapeutic Interventions. (3) Prerequisite(s): ATRN 6104 and ATRN 6106. Corequisite(s): ATRN 6113. Application of rehabilitation techniques and modalities to upper and lower extremity injuries.

ATRN 6113. Patient-Centered Healthcare. (3) Corequisite(s): ATRN 6111. Incorporating an individual's health needs and desired health outcomes in clinical decisions.

ATRN 6114. General Medicine and Pharmacology I. (3) Prerequisite(s): ATRN 5105 or ATRN 6105. The first part of students learning how to evaluate, diagnose, and treat common non-orthopedic medical conditions.

ATRN 6118. Administration for Healthcare Professionals. (3) Prerequisite(s): ATRN 6114. Focuses on business management principles associated with healthcare administration, as well as leadership and professional development.

ATRN 6119. General Medicine and Diagnostic Procedures. (3) Prerequisite(s): ATRN 6114. The second part of learning how to evaluate, diagnose, and treat common non-orthopedic medical conditions. Students continue learning the medications used to treat the non-orthopedic medical conditions. Additionally, students identify and describe various modes of imaging techniques and tests used in sports medicine. Diagnostic procedures covered in the course include, but are not limited to: X-ray, CT scan, MRI, bone scan, fluoroscopy, and PET.

ATRN 6121. Behavioral Health in Sports Medicine. (3) Prerequisite(s): ATRN 6118. Integrates physiological, psychological, and social understanding of humans in relationship to physical activity as a lifelong pursuit. Topics include: physical fitness, nutrition, stress reduction, socialization, and individual differences in human behavior.

ATRN 6400. Introduction to Clinical Care. (1) Prerequisite(s): Admission to MSAT program. Performance of basic athletic training skills under the supervision of a clinical instructor at various sites. Students develop competence in introductory athletic training skills.

ATRN 6401. Clinical Rotation I. (1) Prerequisite(s): ATRN 6101 and ATRN 6102. A semester-long clinical rotation that focuses on the performance of acute management skills, prevention, and protective equipment under the supervision of a clinical instructor at various sites. Students spend approximately 10-15 hours per week at their clinical site.

ATRN 6402. Clinical Rotation II. (1) Prerequisite(s): ATRN 6401. A semester-long clinical rotation that focuses on assessment of lower extremity injuries, rehabilitation techniques, and modalities use under the supervision of a clinical instructor at various sites. Students spend approximately 10-15 hours per week at their clinical site.

ATRN 6403. Clinical Rotation III. (1) Prerequisite(s): ATRN 6402. A clinical rotation that focuses on general medicine and pharmacology under the supervision of a clinical instructor at an assigned clinical site. This rotation includes working with an inter-professional healthcare team with patients across the lifespan. Students spend approximately 10-15 hours per week at their clinical site.

ATRN 6405. Clinical Rotation IV. (3) Prerequisite(s): ATRN 6403. A semester-long clinical rotation that focuses on synthesis and the integration of knowledge, skills, and clinical decision-making into patient care under the supervision of a clinical instructor at various sites. The rotation allows students to participate in the full scope of athletic training clinical practice as part of an inter-professional sports medicine team. Students spend approximately 20-25 hours per week at their clinical site.

ATRN 6406. Clinical Rotation V. (6) Prerequisite(s): ATRN 6405. A semester-long, full-time, clinical immersion rotation that provides the athletic training student the opportunity to gain experience in a specific area of clinical practice that they are interested in pursuing post-graduation. These can include, but are not limited to: out-patient rehabilitation, orthopedic clinics, primary care settings, emergency and acute care, dance medicine, industrial and occupational health, and athletic performance. Students will gain 30-40 hours of clinical field experience per week (minimum of 480 hours required).

Business Administration DBA (BDBA)

BDBA 8100. Introduction to Experimental Design and Measurement. (3) Overview of quasi-experimental design, qualitative techniques, basic statistics, and methodological skills necessary to carry out applied research in the fields of management, marketing, operations management and information systems.

BDBA 8110. Organizational Theories and Systems. (3) Review of a broad range of organizational theory and topics in the fields of management, marketing, operations management and information systems.

BDBA 8120. Professional Issues I. (3) Introduction to the principles of scholarly research for both academic and industry settings, including ethics and research integrity, navigating scholarly literature, focusing on research and teaching excellence.

BDBA 8130. Introduction to Business Theory. (3) Review of fundamental theories and research in the fields of strategic management, marketing, operations management, and information systems.

BDBA 8140. Advanced Business Theory. (3) Review of micro- and meso-theories and research developed in the fields of management, marketing, operations management and information systems.

BDBA 8150. Business Statistics and Data Analysis. (3) Development of basic skills to conduct quantitative and qualitative research in the chosen area of study within the fields of management, marketing, operations management and information systems.

BDBA 8200. Research Methods I. (3) Development and application of advanced research skills. Both advanced quantitative and qualitative research methods are discussed.

BDBA 8210. Current Topics Research Seminar. (3) Review of current topics in the fields of management, marketing, operations management and information systems and development of research skills in the respective focus areas.

BDBA 8220. Professional Issues II. (3) Consideration of advanced topics in the conduct and application of scholarly research within both academic and industry settings.

BDBA 8230. Research Methods II. (3) Development and application of advanced research skills necessary for successfully defending a dissertation proposal, building on Research Methods I. Both advanced quantitative and qualitative research methods are discussed.

BDBA 8240. Focused Research Seminar. (3) Review of current topics identified by the students in the program to support the development of dissertation idea. Topics include: the fields of management, marketing, operations management, and information systems.

BDBA 8350. Dissertation Proposal Development. (3) In-depth discussion of papers and development of research models and approaches in preparation of dissertation work. Collaboration with the intended dissertation chair is desired.

BDBA 8999. Doctoral Dissertation Research. (1 to 9) Each student initiates and conducts an individual investigation culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Bioinformatics (BINF)

BINF 5171. Business of Biotechnology. (3) Prerequisite(s): Admission to a graduate program. Introduces students to the field of biotechnology and how biotech businesses are created and managed. Students should be able to define biotechnology and understand the difference between a biotech company and a pharmaceutical company. Additional concepts covered will include platform technology, biotechnology's history, biotechnology products and development processes, current technologies used by biotech companies today, biotechnology business fundamentals, research and development within biotech companies, exit strategies, and careers in the biotech field.

BINF 5191. Life Sciences and the Law. (3) Prerequisite(s): Admission to a graduate program. Law and regulations permeate our daily lives, and nowhere is this truer than in areas of life sciences. This course explores what the law is, how our current laws developed, and factors currently affecting the evolution of the law. It provides a general overview of U.S. law, including constitutional law, criminal law, contract law, tort law, property law (especially intellectual property law), business law (especially legal aspects of forming a new company), and administrative law. It then focuses on specific aspects of the law affecting the life sciences, such as ownership of tissues and organisms, regulation of drugs and medical devices, regulation of research in the life sciences, the history and regulation of medicine, the economics and various types of health care delivery, and food production.

BINF 6010. Topics in Bioinformatics. (3) Prerequisite(s): permission of the department. Topics in bioinformatics and genomics selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters.

BINF 6100. Biological Basis of Bioinformatics. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics and undergraduate training in Computer Science or other non-biological discipline. This course provides a foundation in molecular genetics and cell biology focusing on foundation topics for graduate training in bioinformatics and genomics.

BINF 6101. Energy and Interaction in Biological Modeling. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics. This course covers: (a) the major organic and inorganic chemical features of biological macromolecules; (b) the physical forces that shape biological molecules, assemblies and cells; (c) the chemical driving forces that govern living systems; (d) the molecular roles of biological macromolecules and common metabolites; (e) and the pathways of energy generation and storage. Each section of the course builds upon the relevant principles in biology and chemistry to explain the most common mathematical and physical abstractions used in modeling in the relevant context.

BINF 6111. Bioinformatics Programming I. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics or permission of instructor. Introduces fundamentals of programming for bioinformatics using a high-level object-oriented language such as Java or Python. Introduces object-oriented programming, analysis of algorithms, and fundamental sequence alignment methods. Students learn productive use of the Unix environment, focusing on Unix utilities that are particularly useful in bioinformatics. Course grade includes performance in BINF 6111L.

BINF 6112. Bioinformatics Programming II. (3) Prerequisite(s): BINF 6111 or permission of instructor. Continuation of BINF 6111. In this second semester, students practice and refine skills learned in the first semester. New topics include: (a) programming as part of a team, using sequence analysis algorithms in realistic settings; (b) writing maintainable and re-usable code; and (c) graphical user interface development. Course grade includes performance in BINF 6111L.

BINF 6151. Professional Communication. (1) Cross-listed Course(s): GRAD 6151. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references and avoiding plagiarism. Students in the course critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students learn how to properly organize and run a meeting.

BINF 6152. Program and Professional Orientation. (1) Students learn to identify key Bioinformatics skill sets and where they are applied in research and industry settings, join appropriate professional networks, use the major professional and research journals in the field, identify key organizations and companies driving intellectual and technology development in bioinformatics, and achieve beginner-level proficiency with key molecular data repositories.

BINF 6153. Career Development in Bioinformatics. (1) Students prepare intensively for the job search, from developing a resume, to identifying appropriate opportunities, to preparing for the interview. Students are expected to complete a final interview practicum with faculty and members of the PSM Executive Board.

BINF 6200. Statistics for Bioinformatics. (3) Prerequisite(s): Permission of department. Introduces students to statistical methods commonly used in bioinformatics. Basic concepts from probability, stochastic processes,

information theory, and other statistical methods are introduced and illustrated by examples from molecular biology, genomics and population genetics with an outline of algorithms and software. R is introduced as the programming language for homework.

BINF 6201. Molecular Sequence Analysis. (3)
Prerequisite(s): BINF 6100 or equivalent. Introduction of the basic computational methods and open sources software commonly used in molecular sequence analysis. Topics include: biological sequence data formats and major public databases, concepts of computer algorithms and complexity, introductions to principle components analysis and data clustering methods, dynamics of genes in populations, evolutionary models of DNA and protein sequences, derivation of amino acid substitution matrices, algorithms for pairwise sequence alignments and multiple sequence alignments, algorithms for fast sequence database search, methods for molecular phylogenetic analysis, hidden Markov models and neural networks for sequence pattern and family recognition, and introductions to genome evolution and omics data analysis.

BINF 6202. Computational Structural Biology. (3)
Prerequisite(s): BINF 6101 and BINF 6201 or their equivalents. Topics include: (a) the fundamental concepts of structural biology (chemical building blocks, structure, superstructure, folding, etc.); (b) structural databases and software for structure visualization; (c) Structure determination and quality assessment; (d) protein structure comparison and the hierarchical nature of biomacromolecular structure classification; (e) protein structure prediction and assessment; and (f) sequence- and structure-based functional site prediction.

BINF 6203. Genomics. (3) Prerequisite(s): BINF 6100 or equivalent. Surveys the application of high-throughput molecular biology and analytical biochemistry methods and data interpretation for those kinds of high volume biological data most commonly encountered by bioinformaticians. The relationship between significant biological questions, modern genomics technology methods, and the bioinformatics solutions that enable interpretation of complex data is emphasized. Topics include: genome sequencing and assembly, annotation, and comparison; genome evolution and individual variation; function prediction; gene ontologies; transcription assay design, data acquisition, and data analysis; and metabolic pathways and databases and their role in genome analysis.

BINF 6204. Mathematical Systems Biology. (3)
Prerequisite(s): BINF 6200 and BINF 6210 or equivalents. Introduces basic concepts, principles and common methods used in systems biology. Emphasizes molecular networks, models and applications, and covers the following topics: (a) the structure of molecular networks; (b) network motifs, their system properties and the roles they play in biological processes; complexity and robustness of molecular networks; (c) hierarchy and modularity of molecular interaction networks; kinetic proofreading; (d) optimal gene circuit design; and (e) the rules for gene regulation.

BINF 6205. Computational Molecular Evolution. (3)
Prerequisite(s): BINF 6201 and BINF 6200 or permission of the instructor. Covers major aspects of molecular evolution and phylogenetics with an emphasis on the modeling and computational aspects of the fields. Topics will include: models of nucleotide substitution, models of amino acid and codon substitution, phylogenetic reconstruction, maximum likelihood methods, Bayesian methods, comparison of phylogenetic methods and tests on trees, neutral and adaptive evolution and simulating molecular evolution. Students will obtain an in-depth knowledge of the various models of evolutionary processes, a conceptual understanding of the methods associated with phylogenetic reconstruction and testing of those methods and develop an ability to take a data-set and address fundamental questions with respect to genome evolution.

BINF 6210. Machine Learning for Bioinformatics. (3)
Prerequisite(s): BINF 6200 and Calculus. Introduction of commonly used machine learning methods in the field of bioinformatics. Topics include: dimension reduction using principal component analysis, singular value decomposition, and linear discriminant analysis, clustering using k-means, hierarchical, expectation maximization approaches, classification using k-nearest neighbor and support vector machines. To help understand these methods, basic concepts from linear algebra, optimization, and information theory are explained. Application of these machine learning methods to solving bioinformatics problems are illustrated using examples from the literature.

BINF 6211. Design and Implementation of Bioinformatics Databases. (3) Prerequisite(s): Permission of instructor. The fundamentals of database modeling as used in bioinformatics. By the end of the course, students should be able to: understand different types of data models, know how hierarchical and relational models work and give examples that are widely used for biological databases, understand the capabilities of a standard, open source RDBMS, understand the tasks required for data integration and how to use SQL as a research tool. Introduction to ML, XML Schema, and BioOntologies as widely used data exchange and organization tools in bioinformatics databases.

BINF 6215. Bioinformatics Pipeline Programming. (3)
Prerequisite(s): BINF 6203. The concept of pipelines – assemblies of basic bioinformatics tools and data sources to solve complex data processing problems. The pipeline

concept is introduced with simple UNIX command line methods, and then extended to the use of preconfigured commercial and extensible open-source workflow management systems. Reproducibility of analysis, collection of analytic provenance information, and database integration is also covered.

BINF 6310. Advanced Statistics for Genomics. (3) Prerequisite(s): BINF 6200 or equivalent. Canonical linear statistics (t-test, ANOVA, PCA) and their non-parametric equivalents. Examines application of Bayesian statistics, Hidden Markov Models and machine learning algorithms to problems in bioinformatics. Students should have fluency in a high-level programming language (PERL, Java, C#, Python or equivalent) and are expected, in assignments, to manipulate and analyze large public data sets. Utilizes the R statistical package with the bioconductor extension.

BINF 6311. Biophysical Modeling. (3) Topics include: (a) overview of mechanical force fields; (b) energy minimization; (c) dynamics simulations (molecular and coarse-grained); (d) Monte-Carlo methods; (e) systematic conformational analysis (grid searches); (f) classical representations of electrostatics (Poisson-Boltzmann, Generalized Born and Colombic); (g) free energy decomposition schemes; and (h) hybrid quantum/classical (QM/MM) methods.

BINF 6312. Computational Comparative Genomics. (3) Prerequisite(s): BINF 6201 or equivalent. Introduces computational methods for comparative genomics analysis. Topics include: (a) the architecture of prokaryotic and eukaryotic genomes; (b) the evolutionary concept in genomics; (c) databases and resources for comparative genomics; (d) principles and methods for sequence analysis; evolution of genomes; (e) comparative gene function annotation; (f) evolution of the central metabolic pathways and regulatory networks; (g) genomes and the protein universe; (h) cis-regulatory binding site prediction; (i) operon and regulon predictions in prokaryotes; and (j) regulatory network mapping and prediction.

BINF 6313. Structure, Function, and Modeling of Nucleic Acids. (3) Prerequisite(s): BINF 6100 and BINF 6101, or their equivalents. Topics include: (a) atomic structure, macromolecular structure-forming tendencies and dynamics of nucleic acids; (b) identification of genes which code for functional nucleic acid molecules, cellular roles and metabolism of nucleic acids; (c) 2D and 3D abstractions of nucleic acid macromolecules and methods for structural modeling and prediction; (d) modeling of hybridization kinetics and equilibria; and (e) hybridization-based molecular biology protocols, detection methods and molecular genetic methods, and the role of modeling in designing these experiments and predicting their outcome.

BINF 6318. Computational Proteomics and Metabolomics. (3) Prerequisite(s): BINF 6200 or equivalent. Introduces commonly used computational algorithms, software tools, and databases for analyzing mass spectrometry-based proteomics and metabolomics data. Students learn how to: 1) implement algorithms for processing raw mass spectrometry data and extracting qualitative and quantitative information about proteins and metabolites; 2) align multiple datasets; 3) perform differential analysis of proteomics and metabolomics datasets; and 4) use commonly used protein and metabolite databases. Introduction of chromatography, mass spectrometry, and isotopic patterns of proteins and metabolites to provide background information for students to understand the nature of mass spectrometry data.

BINF 6350. Biotechnology and Genomics Laboratory. (3) Prerequisite(s): A background in molecular biology and biochemistry or permission of the instructor. Introduction of the molecular biological methods by which samples are converted to a state from which sequence information can be produced. When sequence data is produced in a highly parallel fashion across a large fraction of a genome it is the basis of genomics. For historical reasons, the sample put on a sequencer is called a library, and the art of genomics lies in library construction. The experimental design and the technical details of library construction significantly affect the analyses that are appropriate and the conclusions that can be made. Lectures cover the design of experiments, how to critically read the literature to select an appropriate protocol for a variety of experimental purposes, and follow it to transform a sample into high quality sequence data. Quality control and library validation methods are explained. Topics include: selecting applications tuned to the experiment design to ensure proper data analysis and interpretation.

BINF 6380. Advanced Bioinformatics Programming. (3) Prerequisite(s): BINF 6112 or equivalent or permission of instructor. Advanced algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing. Topics covered depend on instructor expertise and student interest, but may include assembly of short read fragments from next-generation sequencing platforms, clustering algorithms, machine learning, development of multi-threaded applications, developing for multi-core processors and utilization of large clusters and "cloud" supercomputers. Students are expected to complete a significant independent project. Course includes hands-on experience with multi-threaded programming.

BINF 6382. Accelerated Bioinformatics Programming. (3) Prerequisite(s): BINF 6112 or equivalent or permission of instructor. Computationally intensive algorithms in bioinformatics with an emphasis placed on the

implementation of bioinformatics algorithms in the context of parallel processing using modern hardware processor accelerators such as GPUs and FPGAs. Topics covered depend on instructor expertise and student interest but may include multi-threaded applications and developing for multi-core processors and for large clusters and other "cloud" computers. Students are expected to complete a significant independent project.

BINF 6399. Principles of Team Science. (3) Prerequisite(s): Permission of department. Introduction of appropriate project design, implementation, and management skills needed to function as a small team solving typical problems in Bioinformatics. Students are given realistic problems and are required to develop specifications, deliverables, timelines, and costs. Under faculty supervision, the group assigns roles, responsibilities, and deadlines in order to complete the project and then execute the project. At the end of the course, the group produces a written document with deliverables and makes a formal presentation of the project.

BINF 6400. Internship Project. (1 to 3) Prerequisite(s): Admission to graduate standing in Bioinformatics. Project is chosen and completed under the guidance of an industry partner, and results in an acceptable technical report.

BINF 6600. Bioinformatics Seminar. (1) Cross-listed Course(s): BINF 8600. Prerequisite(s): Admission to graduate standing in Bioinformatics. Weekly seminars are given by bioinformatics researchers from within the University and across the world.

BINF 6601. Bioinformatics Journal Club. (1) Prerequisite(s): Admission to graduate standing in Bioinformatics. Each week, a student in the course is assigned to choose and present a paper from the primary bioinformatics literature.

BINF 6880. Independent Study. (1 to 3) Faculty supervised research experience to supplement regular course offerings.

BINF 6900. Master's Thesis. (1 to 3) Prerequisite(s): 12 graduate credit hours and permission of instructor. Project is chosen and completed under the guidance of a graduate faculty member, and will result in an acceptable master's thesis and oral defense. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

BINF 8010. Topics in Bioinformatics. (3) Prerequisite(s): Permission of department. Topics in bioinformatics and genomics selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters.

BINF 8100. Biological Basis of Bioinformatics. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics and undergraduate training in Computer Science or other non-biological discipline. Provides a foundation in molecular genetics and cell biology focusing on foundation topics for graduate training in bioinformatics and genomics.

BINF 8101. Energy and Interaction in Biological Modeling. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics. Topics include: the major organic and inorganic chemical features of biological macromolecules; the physical forces that shape biological molecules, assemblies and cells; the chemical driving forces that govern living systems; the molecular roles of biological macromolecules and common metabolites; and the pathways of energy generation and storage. Each section of the course builds upon the relevant principles in biology and chemistry to explain the most common mathematical and physical abstractions used in modeling in the relevant context.

BINF 8111. Bioinformatics Programming I. (3) Prerequisite(s): Admission to graduate standing in Bioinformatics or permission of instructor. Introduces fundamentals of programming for bioinformatics using a high-level object-oriented language such as Java or Python. Also introduces object-oriented programming, analysis of algorithms and fundamental sequence alignment methods. Students learn productive use of the Unix environment, focusing on Unix utilities that are particularly useful in bioinformatics. Course grade includes performance in BINF 8111L.

BINF 8112. Bioinformatics Programming II. (3) Prerequisite(s): BINF 8111 or permission of instructor. Continuation of BINF 8111. In this second semester, students practice and refine skills learned in the first semester. New topics include: programming as part of a team, using sequence analysis algorithms in realistic settings; writing maintainable and re-usable code; and graphical user interface development.

BINF 8151. Professional Communications. (1) Cross-listed Course(s): GRAD 6151 and GRAD 8151. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references and avoiding plagiarism. Students critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students learn how to properly organize and run a meeting. Students prepare a CV, job application letter, and job talk.

BINF 8200. Statistics for Bioinformatics. (3) Prerequisite(s): Permission of department. Introduction of statistical methods commonly used in bioinformatics. Basic concepts from probability, stochastic processes, information theory, and other statistical methods are

introduced and illustrated by examples from molecular biology, genomics and population genetics with an outline of algorithms and software. R is introduced as the programming language for homework.

BINF 8201. Molecular Sequence Analysis. (3) Prerequisite(s): BINF 8100 or equivalent. Introduction of the basic computational methods and open sources software commonly used in molecular sequence analysis. Topics include: biological sequence data formats and major public databases, concepts of computer algorithms and complexity, introductions to principle components analysis and data clustering methods, dynamics of genes in populations, evolutionary models of DNA and protein sequences, derivation of amino acid substitution matrices, algorithms for pairwise sequence alignments and multiple sequence alignments, algorithms for fast sequence database search, methods for molecular phylogenetic analysis, hidden Markov models and neural networks for sequence pattern and family recognition, and introductions to genome evolution and omics data analysis

BINF 8202. Computational Structural Biology. (3) Prerequisite(s): BINF 8101 and BINF 8201, or their equivalents. Topics include: (a) the fundamental concepts of structural biology (chemical building blocks, structure, superstructure, folding, etc.); (b) structural databases and software for structure visualization; (c) Structure determination and quality assessment; (d) protein structure comparison and the hierarchical nature of biomacromolecular structure classification; (e) protein structure prediction and assessment; and (f) sequence- and structure-based functional site prediction.

BINF 8203. Genomics. (3) Prerequisite(s): BINF 8100 or equivalent. Surveys the application of high-throughput molecular biology and analytical biochemistry methods and data interpretation for those kinds of high volume biological data most commonly encountered by bioinformaticians. The relationship between significant biological questions, modern genomics technology methods, and the bioinformatics solutions that enable interpretation of complex data is emphasized. Topics include: genome sequencing and assembly, annotation, and comparison; genome evolution and individual variation; function prediction; gene ontologies; transcription assay design, data acquisition, and data analysis; metabolic pathways and databases and their role in genome analysis.

BINF 8204. Mathematical Systems Biology. (3) Prerequisite(s): BINF 8200 and BINF 8210, or equivalents. Introduces basic concepts, principles and common methods used in systems biology. Emphasizes on molecular networks, models and applications, and covers the following topics: the structure of molecular networks; network motifs, their system properties and the roles they play in biological processes; complexity and robustness of molecular networks; hierarchy and modularity of molecular interaction networks; kinetic proofreading; optimal gene circuit design; and the rules for gene regulation.

BINF 8205. Computational Molecular Evolution. (3) Prerequisite(s): BINF 8200 and BINF 8201, or permission of the instructor. Major aspects of molecular evolution and phylogenetics with an emphasis on the modeling and computational aspects of the fields. Topics include: models of nucleotide substitution, models of amino acid and codon substitution, phylogenetic reconstruction, maximum likelihood methods, Bayesian methods, comparison of phylogenetic methods and tests on trees, neutral and adaptive evolution and simulating molecular evolution. Students obtain an in-depth knowledge of the various models of evolutionary processes, a conceptual understanding of the methods associated with phylogenetic reconstruction and testing of those methods and develop an ability to take a data-set and address fundamental questions with respect to genome evolution.

BINF 8210. Machine Learning for Bioinformatics. (3) Prerequisite(s): BINF 8200 and Calculus. Introduces commonly used machine learning methods in the field of bioinformatics. Topics include: dimension reduction using principal component analysis, singular value decomposition, and linear discriminant analysis, clustering using k-means, hierarchical, expectation maximization approaches, classification using k-nearest neighbor and support vector machines. To help understand these methods, basic concepts from linear algebra, optimization, and information theory are explained. Application of these machine learning methods to solving bioinformatics problems are illustrated using examples from the literature.

BINF 8211. Design and Implementation of Bioinformatics Databases. (3) Prerequisite(s): Permission of instructor. Introduces the fundamentals of database modeling as used in bioinformatics. By the end of the course, students are able to: understand different types of data models, know how hierarchical and relational models work and give examples that are widely used for biological databases, understand the capabilities of a standard, open source RDBMS, understand the tasks required for data integration and how to use SQL as a research tool. Introduction of XML, XML Schema, and BioOntologies as widely used data exchange and organization tools in bioinformatics databases.

BINF 8310. Advanced Statistics for Genomics. (3) Prerequisite(s): BINF 8200 or equivalent. Canonical linear statistics (t-test, ANOVA, PCA) and their non-parametric equivalents. Examines the application of Bayesian statistics, Hidden Markov Models and machine learning algorithms to problems in bioinformatics. Students should have fluency in a high-level programming language (PERL,

Java, C#, Python or equivalent) and are expected, in assignments, to manipulate and analyze large public data sets. Utilizes the R statistical package with the bioconductor extension.

BINF 8311. Biophysical Modeling. (3) Topics include: an overview of mechanical force fields; energy minimization; dynamics simulations (molecular and coarse-grained); Monte-Carlo methods; systematic conformational analysis (grid searches); classical representations of electrostatics (Poisson-Boltzmann, Generalized Born and Coulombic); free energy decomposition schemes; and hybrid quantum/classical (QM/MM) methods.

BINF 8312. Computational Comparative Genomics. (3) Prerequisite(s): BINF 8201 or equivalent. Introduces computational methods for comparative genomics analyses. The course covers the following topics: the architecture of prokaryotic and eukaryotic genomes; the evolutionary concept in genomics; databases and resources for comparative genomics; principles and methods for sequence analysis; evolution of genomes; comparative gene function annotation; evolution of the central metabolic pathways and regulatory networks; genomes and the protein universe; cis-regulatory binding site prediction; operon and regulon predictions in prokaryotes; and regulatory network mapping and prediction.

BINF 8313. Structure, Function, and Modeling of Nucleic Acids. (3) Prerequisite(s): BINF 8100 and BINF 8101, or equivalents. Topics include: atomic structure, macromolecular structure-forming tendencies and dynamics of nucleic acids; identification of genes which code for functional nucleic acid molecules, cellular roles and metabolism of nucleic acids; 2D and 3D abstractions of nucleic acid macromolecules and methods for structural modeling and prediction; modeling of hybridization kinetics and equilibria; and hybridization-based molecular biology protocols, detection methods and molecular genetic methods, and the role of modeling in designing these experiments and predicting their outcome.

BINF 8318. Computational Proteomics and Metabolomics. (3) Prerequisite(s): BINF 8200 or equivalent. Introduces commonly used computational algorithms, software tools, and databases for analyzing mass spectrometry-based proteomics and metabolomics data. Students learn how to: 1) implement algorithms for processing raw mass spectrometry data and extracting qualitative and quantitative information about proteins and metabolites; 2) align multiple datasets; 3) perform differential analysis of proteomics and metabolomics datasets; and 4) use commonly used protein and metabolite databases. Also introduces chromatography, mass spectrometry, and isotopic patterns of proteins and metabolites to provide background information for understanding the nature of mass spectrometry data.

BINF 8350. Biotechnology and Genomics Laboratory (3). Prerequisite(s): A background in molecular biology and biochemistry or permission of instructor. Introduction to the molecular biological methods by which samples are converted to a state from which sequence information can be produced. When sequence data is produced in a highly parallel fashion across a large fraction of a genome it is the basis of genomics. For historical reasons, the sample put on a sequencer is called a library, and the art of genomics lies in library construction. The experimental design and the technical details of library construction significantly affects the analyses that are appropriate and the conclusions that can be made. Lectures cover the design of experiments, how to critically read the literature to select an appropriate protocol for a variety of experimental purposes, and follow it to transform a sample into high quality sequence data. Quality control and library validation methods are explained. Topics include: selecting applications tuned to the experiment design to ensure proper data analysis and interpretation.

BINF 8380. Advanced Bioinformatics Programming. (3) Prerequisite(s): BINF 8112 or equivalent, or permission of instructor. Advanced algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing. Topics covered depend on instructor expertise and student interest, but may include assembly of short read fragments from next-generation sequencing platforms, clustering algorithms, machine learning, development of multi-threaded applications, developing for multi-core processors and utilization of large clusters and "cloud" supercomputers. Students are expected to complete a significant independent project. Course includes hands-on experience with multi-threaded programming.

BINF 8382. Accelerated Bioinformatics Programming. (3) Prerequisite(s): BINF 8112 or equivalent, or permission of instructor. Computationally intensive algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing using modern hardware processor accelerators such as GPUs and FPGAs. Topics covered depend on instructor expertise and student interest but may include multi-threaded applications and developing for multi-core processors and for large clusters and other "cloud" computers. Students are expected to complete a significant independent project.

BINF 8600. Bioinformatics Seminar. (1) Cross-listed Course(s): BINF 6600. Prerequisite(s): Admission to graduate standing in Bioinformatics. Departmental seminar. Weekly seminars will be given by bioinformatics

researchers from within the University and across the world. *May be repeated for credit.*

BINF 8601. Bioinformatics Journal Club. (1) Prerequisite(s): Admission to graduate standing in Bioinformatics. Each week, a student in the class is assigned to choose and present a paper from the primary bioinformatics literature.

BINF 8911. Bioinformatics Research Rotation I. (2) Faculty supervised research experience in bioinformatics to supplement regular course offerings.

BINF 8912. Bioinformatics Research Rotation II. (2) Faculty supervised research experience in bioinformatics to supplement regular course offerings.

BINF 8990. Pre-Dissertation Research. (1 to 9) Prerequisite(s): Permission of department. Students conduct research in bioinformatics under the direction of one or more Bioinformatics faculty. A major goal of this course is to prepare the student for the Qualifying Examination. *May be repeated for credit up to 9 credit hours.*

BINF 8991. Doctoral Dissertation Research. (1 to 9) Individual investigation culminating in the preparation and presentation of a doctoral dissertation. A student may register for multiple sections of this course in the same semester or different semesters. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Biology (BIOL)

BIOL 5000. Advanced Topics in Biology. (1 to 4) Courses in selected topics and advanced studies in biology. Lecture and laboratory hours will vary with the topics taught. *May be repeated for credit with change of topic.*

BIOL 5111. Evolution. (3) Prerequisite(s): BIOL 3166. Theories of evolution and forces, which affect gene frequencies.

BIOL 5121. Advanced Biometry. (4) Prerequisite(s): BIOL 2140 or equivalent, BIOL 3166 or equivalent, and one STAT course. Advanced biostatistics design and analysis of experiments. Three lecture hours and one laboratory period of three hours a week.

BIOL 5144. Advanced Ecology. (4) Energy flow, nutrient cycles, community structure, population growth and regulation. Three lecture hours and one laboratory period of three hours a week.

BIOL 5162. Advanced Biotechnology I. (3) Prerequisite(s): BIOL 3161 or BIOL 3166 with grade of C or above. Problem-based learning approach where students work in teams to develop solution strategies that use biotechnology to solve real-world problems. Three lecture hours per week.

BIOL 5163. Advanced Biotechnology II. (3) Prerequisite(s): BIOL 3161 or BIOL 3166 with grade of C or above and permission of instructor. Students work in teams to implement solution strategies developed in BIOL 5162 that use biotechnology to solve real-world problems. One laboratory period and two lecture hours per week.

BIOL 5167. Medical Genetics. (3) Prerequisite(s): Admission to Graduate School in Biology or permission of instructor. Various applications of genetics to human health, including studies of the inheritance of diseases in families, mapping of disease genes to specific locations on chromosomes, analyses of the molecular mechanisms through which genes cause disease, diagnosis and treatment of genetic disease, and genetic counseling.

BIOL 5168. Recombinant DNA Techniques. (4) Modern molecular biological methods (such as DNA cloning, gel electrophoresis, nucleic acid hybridization, PCR, and DNA sequencing) data analysis and interpretation. One lecture hour and two laboratory periods of three hours a week.

BIOL 5171. Cell Physiology. (3) The fundamental physicochemical properties of cells.

BIOL 5184. Plant Biotechnology. (3) A laboratory-oriented course designed to integrate plant molecular biology, recombinant DNA technology, and plant cell and tissue culture. One lecture hour and two laboratory periods of three hours a week.

BIOL 5189. Mechanisms in Development. (3) Cellular and molecular bases of differentiation; an exploration of the experimental analysis of causal and controlling factors in development.

BIOL 5199. Molecular Biology. (3) Structural and functional interaction of nucleic acids and proteins in the replication, transcription and translation of genetic material.

BIOL 5205. Advanced Horticulture. (3) Topics in ornamental horticulture and landscaping, including greenhouse projects and field trips. Two lecture hours and three hours of lab a week.

BIOL 5221. Plant Systematics. (4) Identification and classification of vascular plants, including experimental concepts of speciation. Three lecture hours and one laboratory period of three hours a week.

BIOL 5229. Dendrology. (4) The identification, structure, function, ecology, reproduction, and evolutionary

relationships of woody plants. Three lecture hours and one three-hour lab a week.

BIOL 5233. Parasitology.(3) Prerequisite(s): BIOL 2130. Morphology, life cycles, ecology, taxonomy, and medical and economic importance of parasites. Three lecture hours a week.

BIOL 5234. Wildlife Biology. (3) Concepts, principles and techniques of wildlife biology. Identification and life histories with emphasis on the value, study attraction, management, conservation and control of wildlife species.

BIOL 5235. Mammalogy. (4) Prerequisite(s): BIOL 3111. Taxonomy, anatomy, physiology and life histories of the mammals. Three lecture hours and one laboratory period of three hours a week.

BIOL 5242. The Biology of Birds. (3) Prerequisite(s): BIOL 3144 or permission of department. Overview of general avian biology, including taxonomy and anatomy, but concentrating on behavior, ecology and conservation of birds. Focus is on birds of the southeastern U.S.

BIOL 5242L. The Biology of Birds Lab. (1) Meets for one three-hour period per week. The laboratory and field portion of the Biology of Birds focus on field identification and inventory techniques, with an introduction to anatomy. Students will need binoculars.

BIOL 5243. Animal Behavior. (3) An ethological approach to how animals respond to their environment. Causation, development and adaptive significance of behavior in social systems.

BIOL 5244. Conservation Biology. (3) Conservation values, extinction rates, genetic diversity, demography, habitat fragmentation, reserve management, ecological restoration.

BIOL 5250. Microbiology. (3) Morphology, physiology, pathogenicity, metabolism and ecology of micro-organisms.

BIOL 5250L. Microbiology Laboratory. (1) Pre- or Corequisite(s): BIOL 5250. One laboratory period of three hours a week.

BIOL 5251. Immunology. (3) Cellular, molecular, and genetic basis for immunity; physical chemistry of antigens and antibodies and their interactions; defense mechanisms.

BIOL 5251L. Immunology Laboratory. (1) Pre- or Corequisite(s): BIOL 5251. One laboratory period of three hours a week.

BIOL 5253. Marine Microbiology. (4) Bacteria, fungi and viruses of marine origin, and their response to the salt, temperature, pressure and nutrient environment of the ocean. Roles of marine microorganisms in public health, pollution and fouling. Three lecture hours and one laboratory period of three hours a week.

BIOL 5254. Epidemiology. (3) History and practices of epidemiology with emphasis on modes of transmission of clinically important infectious agents and the analysis of epidemiological data. Three lecture hours a week.

BIOL 5255. Bacterial Genetics. (3) Regulation of gene expression in bacterial systems. Bacteriophage genetics. DNA transfer in bacteria.

BIOL 5256. Pathogenic Bacteriology. (3) Cellular and molecular interactions of mammalian hosts with procaryotic parasites.

BIOL 5256L. Pathogenic Bacteriology Laboratory. (1) One laboratory period of three hours a week.

BIOL 5257. Microbial Physiology and Metabolism. (3) Bacterial cell growth and division, transport mechanisms, catabolism and energy production, biosynthesis of cellular components, global regulation of gene expression in response to the environment, and cell-cell communication between bacteria.

BIOL 5258. Epidemics and Plagues. (3) Prerequisite(s): Admission to the Ph.D. or Master's in Biology program or permission of instructor. A study of the history, modeling, epidemiology, environmental, and behavioral changes that contributed to the development of selected epidemics and plagues which have dramatically affected plants, agricultural animals, and humans.

BIOL 5259. Advanced Virology. (3) Prerequisite(s): BIOL 3166, BIOL 4199, or BIOL 4250 with a grade of C or above. Focus on molecular biology, evolution, and pathogenesis of clinically relevant human and animal viruses. Additional topics include: advances in virus-based gene therapy, vaccines and anticancer agents; viruses as potential bioterrorism threats; bacteriophages and plant viruses; unusual virus-like agents.

BIOL 5259L. Advanced Virology Laboratory. (1) Pre- or Corequisite(s): BIOL 5259. One laboratory period of three hours per week.

BIOL 5260. Population Genetics (3) The genetics of qualitative and quantitative traits in populations, including an assessment of the factors affecting the extent and pattern of the genetic variation in these traits.

BIOL 5265. Drugs: Molecular and Cellular Mechanisms. (3) Prerequisite(s): Admission to the Ph.D. or Master's in Biology program or permission of instructor. A detailed focus on representative drugs and their target cells and organs to understand mechanisms of action at a molecular and cellular level. Drug discovery, approval, and economics are also discussed.

BIOL 5277. Endocrinology. (3) Endocrine glands and their physiological roles in metabolism, growth and reproduction.

BIOL 5279. Neurobiology. (3) Prerequisite(s): Biology graduate student or permission from instructor. The molecular and cellular processes of neuronal function in the human central and peripheral nervous systems.

BIOL 5282. Developmental Plant Anatomy. (3) Study of plant cells, tissues, organs and patterns of growth and differentiation.

BIOL 5282L. Developmental Plant Anatomy Laboratory. (1) Pre- or Corequisite(s): BIOL 5282. One laboratory period of three hours a week.

BIOL 5283. Developmental Biology. (3) Cross-listed Course(s): BIOL 4283. Developmental processes occurring chiefly during gametogenesis, fertilization, early embryogenesis, and organogenesis.

BIOL 5283L. Developmental Biology Laboratory. (1) Pre- or Corequisite(s): BIOL 5283. One laboratory period of three hours a week.

BIOL 5284. Eukaryotic Microbiology. (4) Cross-listed Course(s): BIOL 4284. Prerequisite(s): Admission to graduate Biology program or permission of instructor. The biology of free-living, parasitic, and pathogenic eukaryotic microorganisms with emphasis on systematics, cell physiology, ecology, and molecular biology of species contributing to global environmental cycles, animal and crop disease, death, and economic loss. Three hours of lecture and one three hour laboratory period per week.

BIOL 5292. Advances in Immunology. (3) Current topics in immunology with particular emphasis upon the genetic systems and molecular mechanisms underlying immune reactions.

BIOL 5293. Comparative Vertebrate Anatomy. (4) Prerequisite(s): BIOL 2111. Comparative studies of the anatomy, physiology and functional adaptations of selected vertebrates with emphasis on evolutionary developments, especially in mammals. Three lecture hours and one laboratory period of three hours a week.

BIOL 6000. Special Topics in Biology. (1 to 4) Prerequisite(s): Permission of department. Courses in selected topics and advanced studies in biology. Lecture and laboratory hours will vary with the courses taught. *May be repeated for credit.*

BIOL 6010. Special Topics in Microbiology. (1 to 4) Prerequisite(s): Permission of department. Advanced courses in microbiology. *May be repeated for credit with change of topic.* Lecture and laboratory hours will vary with the courses taught. *May be repeated for credit.*

BIOL 6101. Hypothesis Testing. (3) Prerequisite(s): Admission to the M.S. in Biology program or permission of department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature.

BIOL 6102. Cell and Molecular Biology. (3) Structure of cellular components; the cell cycle; regulation of transcription, translation, and protein trafficking; cell membranes and transport; cell-cell communication, including signal transduction; extracellular matrix.

BIOL 6103. Immunology of Infection. (4) Prerequisite(s): BIOL 6102 and CHEM 6101, or permission of instructor. The interaction between the host immune system and microorganisms or viruses explored at the genetic and physiological levels with emphases on the process of infection; intracellular invasion and survival/replication; its modulation by resident microbiota and the host's innate and adaptive immune responses; the utility of pathogenic agents for the exploration of host resistance and immunity. Thirty two-hour lectures.

BIOL 6104. Integrative Systems Physiology. (4) Prerequisite(s): CHEM 6101, BIOL 6102, BIOL 6103, or permission of instructor. The functioning of an intact mammalian organism with an emphasis on human physiology. Traditional survey of organ systems' functions, and problems of the response of cells within tissues to stress and their impact on organismal response. Thirty two-hour lectures.

BIOL 6140. Evolutionary Biology. (3) Prerequisite(s): Admission to the M.S. in Biology program or permission of department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns.

BIOL 6241. Environmental Biology. (3) Prerequisite(s): Admission to the M.S. in Biology program or permission of department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current

research topics and issues related to impacts of human activities on environmental processes.

BIOL 6260. Careers in Bioscience: Professional Development and Responsible Conduct. (2) Prerequisite(s): Admission to M.S. in Biology program or permission of department. Professional development for Master's students. The focus is on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. Hybrid course composed of class meetings and MOODLE tasks.

BIOL 6270. Biological Pathways and Metabolism. (3) Prerequisite(s): Admission to the M.S. in Biology program or permission of department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics.

BIOL 6273. Advanced Human Physiology. (3) Prerequisite(s): Admission to MSN program. Advanced course in human physiology stressing the interaction between physiological systems.

BIOL 6274. Advanced Human Pathophysiology. (3) Prerequisite(s): Admission to MSN program. Advanced course in human pathophysiology stressing the loss of normal function interaction in physiological systems.

BIOL 6366. Advanced Protein Biotechnology. (3) Cross-listed Course(s): BIOL 8366. Prerequisite(s): BIOL 6270 or BIOL 8270. The study of proteins is important in most modern molecular biology laboratories. In this course, students learn the principles behind a range of commonly used molecular biology techniques and how to optimize them. Also included are state-of-the-art methodologies such as CRISPR-CAS9 and mass spectrometry. By the end of the course, students are able to design and optimize complex protein-based experiments. All students interested in cell/molecular biology, biotechnology, and cancer biology are encouraged to participate.

BIOL 6400. Internship Project. (1 to 3) Prerequisite(s): Admission to Biology graduate program. An individualized mentored internship or project chosen and completed under the guidance of an industry or external partner. The internship is part of the approved plan of study for experiential learning by registered graduate students. Results from the internships are reported in an acceptable report. *May be repeated for credit with approval.*

BIOL 6600. Seminar. (1 to 2) Topics of current emphasis in biology. *May be repeated for credit.*

BIOL 6800. Tutorial. (1 to 4) Directed study in areas of specialization in biology and related fields. Maximum credit toward degree: four hours. *Graded on a Pass/Unsatisfactory or IP basis.*

BIOL 6900. Research and Thesis. (1 to 8) Laboratory research for the thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

BIOL 6901. Laboratory Research. (1 to 2) Directed laboratory research in areas of specialization in biology and related fields. Maximum credit toward non-thesis Master's degree = two hours. *Graded on a Pass/Unsatisfactory basis.*

BIOL 8000. Special Topics in Biology. (1 to 4) Prerequisite(s): Permission of department. Courses in selected topics and advanced studies in biology. Lecture and laboratory hours vary with the courses taught. *May be repeated for credit.*

BIOL 8010. Special Topics in Microbiology. (1 to 4) Prerequisite(s): Permission of department. Advanced courses in microbiology. *May be repeated for credit with change of topic.* Lecture and laboratory hours vary with the courses taught. *May be repeated for credit.*

BIOL 8101. Hypothesis Testing. (3) Prerequisite(s): Admission to the Ph.D. in Biology program or permission of department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature.

BIOL 8102. Cell and Molecular Biology. (3) Prerequisite(s): Admission to Ph.D. in Biology program or permission of department. Structure of cellular components; the cell cycle; regulation of transcription, translation, and protein trafficking; cell membranes and transport; cell-cell communication, including signal transduction; extracellular matrix.

BIOL 8103. Immunology of Infection. (4) Prerequisite(s): BIOL 8101 and CHEM 8101, or permission of instructor. The interaction between the host immune system and microorganisms or viruses explored at the genetic and physiological levels with emphases on the process of infection; intracellular invasion and survival/replication; its modulation by resident microbiota and the host's innate and adaptive immune responses; the utility of pathogenic agents for the exploration of host resistance and immunity. Thirty two-hour lectures.

BIOL 8104. Integrative Systems Physiology. (4) Prerequisite(s): BIOL 8102, BIOL 8103, CHEM 8101, or permission of instructor. The functioning of an intact mammalian organism with an emphasis on human physiology. Traditional survey of organ systems' functions,

and problems of the response of cells within tissues to stress and their impact on organismal response.

BIOL 8140. Evolutionary Biology. (3) Prerequisite(s): Admission to the Ph.D. in Biology program or permission of department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns.

BIOL 8200. Interdisciplinary Colloquium. (1) Prerequisite(s): Admission to the Ph.D. in Biology program. Discussion and analysis of topics of current emphasis in biomedicine and biotechnology. *May be repeated for credit.*

BIOL 8201. Seminar. (1) Prerequisite(s): Admission to the Interdisciplinary Ph.D. in Biology program. Formal student presentations of current literature topics. *May be repeated for credit.*

BIOL 8241. Environmental Biology. (3) Prerequisite(s): Admission to the Ph.D. in Biology program or permission of department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes.

BIOL 8260. Careers in Bioscience: Professional Development and Responsible Conduct. (2) Prerequisite(s): Admission to the Ph.D. in Biology program or permission of department. Professional development for Ph.D. students and post-doctoral fellows. The focus is on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. Hybrid course composed of class meetings and MOODLE tasks.

BIOL 8270. Biological Pathways and Metabolism. (3) Prerequisite(s): Admission to Ph.D. in Biology program or permission of department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics.

BIOL 8366. Advanced Protein Biotechnology. (3) Cross-listed Course(s): BIOL 6366. Prerequisite(s): BIOL 6270 or BIOL 8270. The study of proteins is important in most modern molecular biology laboratories. In this course, students learn the principles behind a range of commonly used molecular biology techniques and how to optimize them. Also included are state-of-the-art methodologies such as CRISPR-CAS9 and mass spectrometry. By the end of the course, students are able to design and optimize complex protein-based experiments. All students interested in cell/molecular biology, biotechnology, and cancer biology are encouraged to participate.

BIOL 8800. Laboratory Rotations. (2) Prerequisite(s): Admission to the Ph.D. in Biology program. Directed study in an area of specialization. *May be repeated for credit. Graded on a Pass/Unsatisfactory basis.*

BIOL 8999. Doctoral Dissertation Research. (0 to 9) Prerequisite(s): Admission to the Ph.D. in Biology program. Individual investigation that culminates in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Business Administration Ph.D. (BPHD)

BPHD 8100. Microeconomic Theory I. (3) Prerequisite(s): Admission to Ph.D. in Business Administration or Permission of Instructor. Theories of the firm, of the consumer, and of resource owners; determination of prices under different market structures; general equilibrium analysis and welfare economics.

BPHD 8110. Microeconomic Theory II. (3) Prerequisite(s): BPHD 8100. Study of game theory, its applications in microeconomic theory and finance, and topics on market equilibrium and market failure. The topics cover simultaneous-move games, dynamic games, analysis of competitive markets, market power, adverse selection and the principal-agent problem.

BPHD 8120. Econometrics I. (3) Prerequisite(s): Admission to the Ph.D. in Business Administration or Permission of Instructor. Advanced study of the theory and application of statistics to economic problems. Topics include: the derivation of least squares estimators, maximum likelihood estimation, and problems of multicollinearity, heteroskedasticity, and autocorrelation.

BPHD 8130. Econometrics II. (3) Prerequisite(s): BPHD 8120. Advanced course in cross-section and panel data methods. Focus on underlying assumptions regarding the population, specification, estimation, and testing of microeconometric models. Students become acquainted with a variety of extensions of conventional linear models for cross-sectional and panel data, including panel data models, instrumental variables models, simultaneous equations models, and qualitative response models.

BPHD 8140. Econometrics III. (3) Prerequisite(s): BPHD 8130. Advanced study of the econometric methods applicable to financial economic modeling. Examines the predictability of stock market returns, the event study methodology,

single factor and multifactor models, basic principles of portfolio theory and portfolio evaluation. The course also covers topics on volatility modeling and fixed-income securities.

BPHD 8200. Financial Economic Theory I. (3) Prerequisite(s): Admission to Ph.D. in Business Administration program or permission of instructor. Examines the main themes of financial economics using discrete-time models. Topics include: mean-variance analysis, risk management principle, capital asset pricing model (CAPM), linear factor model, the arbitrage pricing theory, market completes, consumption-based CAPM, multi-period consumption and portfolio choice, market equilibrium, and contingent claim pricing.

BPHD 8210. Investments and Portfolio Theory. (3) Prerequisite(s): BPHD 8200. Detailed introduction to modern investment and portfolio theory, including asset pricing. Covers standard and non-standard CAPM analysis, APT, stochastic dominance, efficient frontier analysis, optimal portfolio selection, fixed income and bond portfolios, options, futures pricing and evaluation of portfolio performance. The goal of the course is to provide a solid foundation in investments for students who will take further advanced courses in asset pricing.

BPHD 8220. Financial Economic Theory II. (3) Prerequisite(s): BPHD 8210. Introduction to asset pricing and portfolio choice theory. The course begins with discrete-time models, and then moves to a continuous-time setting. Topics include: arbitrage, stochastic discount factors, beta pricing models, factor models, dynamic programming, derivative securities and models of the term structure of interest rates.

BPHD 8230. Theory of Corporate Finance. (3) Prerequisite(s): BPHD 8200. Examines the theory and evidence concerning major corporate financial policy issues including capital structure, payout policy, security design and issuance, capital budgeting, mergers and acquisitions, agency theory and financial contracting, and the market for corporate control.

BPHD 8240. Derivatives. (3) Prerequisite(s): BPHD 8200. Theory and practice of financial derivatives markets including forwards, futures, options and interest rate markets. Topics include: the economics of derivatives markets, pricing models for instruments in these markets, strategies for hedging and speculation, as well as regulatory and governance issues. Special attention is placed on the development of pricing models and advanced analytic techniques.

BPHD 8650. Advanced Seminar in Finance. (3) Prerequisite(s): Permission of Instructor. Advanced topics in Finance. Topics will vary. *May be repeated for credit with change in topic.*

BPHD 8999. Doctoral Dissertation Research. (1 to 9) Prerequisite(s): Admission to Candidacy for the Ph.D. in Business Administration. Each student initiates and conducts an individual investigation culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Civil and Environmental Engineering (CEGR)

CEGR 5090. Special Topics in Civil Engineering. (1 to 4) Study of specific new areas emerging in the various fields of civil engineering. *May be repeated for credit.*

CEGR 5108. Finite Element Analysis and Applications. (3) Prerequisite(s): CEGR 4224 and permission of department. Finite element method and its application to engineering problems. Application of displacement method to plane stress, plane strain, plate bending and axisymmetrical bodies. Topics include: dynamics, fluid mechanics, and structural mechanics.

CEGR 5121. Prestressed Concrete Design. (3) Prerequisite(s): CEGR 3225, CEGR 4224, and permission of department. Analysis and design of prestressed components and systems, including materials and systems for prestressing, loss of prestress, flexural and shear design in accordance with current building codes, analysis of indeterminate prestressed systems, and control of camber, deflection and cracking.

CEGR 5122. Power Plant Design. (3) Cross-listed Course(s): CEGR 4122. Prerequisite(s): CEGR 2102, CEGR 3122, and CEGR 3278. Coverage of basic aspects of power generation, including fossil fuel, nuclear, gas, bio, hydro, solar, and wind; analysis and design of infrastructure components and systems in energy production and distribution facilities with a focus on structural and geotechnical systems; history of energy and power; key governing codes, policies and/or regulations for energy facilities; economic and management comparisons of energy alternatives; quality assurance requirements; layouts of power plant sites.

CEGR 5123. Bridge Design. (3) Prerequisite(s): CEGR 3221, CEGR 3225, and permission of department. Review of bridge design codes and loadings; superstructure and substructure design of short, intermediate, and long span bridges constructed of steel and concrete; earthquake design; segmental and cable-stayed bridges.

CEGR 5125. Forensic Engineering. (3) Prerequisite(s): CEGR 3122 and permission of department. Evaluation of structural and construction failures through review of case studies, types and causes of failures, and relevant methods of failure investigation; analysis of failures occurring in a variety of structures, involving a variety of materials, and resulting from a variety of causes; development, expression, and defense of opinions and conclusions, orally and in writing, with an understanding of the impact on the legal process surrounding a failure claim.

CEGR 5126. Codes, Loads, and Nodes. (3) Prerequisite(s): CEGR 3122 and permission of department. Building systems and components; code requirements according to the latest ASCE Standard 7 pertaining to buildings and other structures; gravity load analysis including dead, live, roof live and snow loads; lateral load analysis focusing on wind and seismic forces, and applied to the main lateral load resisting systems; software applications using the SAP2000 tool, with 2-D and 3-D models loaded with gravity and lateral loads.

CEGR 5127. Green Building and Integrative Design. (3) Prerequisite(s): CEGR 3122 and permission of department. Prepares students to function in multidisciplinary design teams working to produce buildings, sites and coupled environmental-infrastructure systems with resilience and sustainability as design priorities. Focus areas include: civil engineering aspects of energy use, material use, emissions generation and design strategies for integrated design.

CEGR 5128. Matrix Methods of Structural Analysis. (3) Prerequisite(s): permission of department. Derivation of the basic equations governing linear structural systems. Application of stiffness and flexibility methods to trusses and frames. Solution techniques utilizing digital computer.

CEGR 5141. Process Engineering. (3) Prerequisite(s): CEGR 3141 and permission of department. Applications of material and energy balance principles to the study of chemical, biological and environmental engineering processes. Overview of applied biotechnology, engineering thermodynamics and kinetics.

CEGR 5142. Water Treatment Engineering. (3) Prerequisite(s): CEGR 3141 and permission of department. Analysis and design of water and wastewater treatment processes including: physical, chemical and biological treatment. Computer-aided design of treatment systems.

CEGR 5143. Solid Waste Management. (3) Prerequisite(s): CEGR 3141 and permission of department. Solid waste management, sources, generation rates, processing and handling, disposal, recycling, landfill closures, and remedial actions for abandoned waste sites.

CEGR 5144. Engineering Hydrology. (3) Prerequisite(s): CEGR 3143 and permission of department. A quantitative study of the various components of the water cycle, including precipitation, runoff, ground water flow, evaporation and transpiration, and stream flow. Hydrograph analysis, flood routing, frequency and duration, reservoir design, and computer applications.

CEGR 5145. Groundwater Resources Engineering. (3) Prerequisite(s): CEGR 3143 and permission of department. Overview of hydrological cycle. Principles of groundwater flow and well hydraulics. Regional groundwater flow and flow nets. Water chemistry and contamination. Applications of groundwater modeling.

CEGR 5146. Advanced Engineering Hydraulics. (3) Prerequisite(s): CEGR 3143 and permission of department. Problems of liquids as applied in civil engineering; open channel flow; dams and spillways; water power; river flow and backwater curves; pipe networks, fire flow, sewage collection, groundwater, computer applications.

CEGR 5147. Stormwater Management. (3) Prerequisite(s): CEGR 3143, CEGR 3141, permission of instructor, and graduate standing. Introduction to the impacts and water quality parameters due to urbanization. Develop a numerical model to analyze water stormwater impacts and evaluate different mitigation methods. Understand and utilize the guiding principles of low impact design (LID) and evaluate the available BMPs and understand their limitations.

CEGR 5161. Advanced Traffic Engineering. (3) Prerequisite(s): CEGR 3161 and permission of department. Analysis of basic characteristics of drivers, vehicles and roadway that affect the performance of road systems. Stream flow elements, volume, density, speed. Techniques of traffic engineering measurements, investigations and data analysis, capacity analysis. Intersections, accidents, parking.

CEGR 5162. Transportation Planning. (3) Prerequisite(s): CEGR 3161 and permission of department. Urban transportation; travel characteristics of urban transportation systems; analysis of transportation-oriented studies; analytic methods of traffic generation, distribution, modal split and assignment; traffic flow theory.

CEGR 5168. Airport Planning and Design. (3) Cross-listed Course(s): CEGR 4168. Prerequisite(s): CEGR 3161 and permission of department. The principles of airport planning and design are studied. Covers essential elements of current airport planning and design trends, including airport master planning and layout plans, forecasting, capacity and delay effects, geometric design and layout of airfields including signage and lighting, and the organization and layout of terminal facilities. Also

focuses on environmental planning, such as hazardous wildlife attractants, airport noise, and compatible land use. Additionally, it explores the financing options related to capital development of airports, including grants, passenger facility charges, and bonds.

CEGR 5171. Urban Public Transportation. (3) Prerequisite(s): CEGR 3161 and permission of department. Planning, design, and operation of bus, rail, and other public modes. Relationship between particular modes and characteristics of urban areas. Funding, security and other administrative issues.

CEGR 5181. Human Factors in Traffic Engineering. (3) Prerequisite(s): CEGR 3161 and permission of department. Study of the driver's and pedestrian's relationship with the traffic system, including roadway, vehicle and environment. Consideration of the driving task, driver and pedestrian characteristics, performance and limitations with regard to traffic facility design and operation.

CEGR 5182. Transportation Environmental Assessment. (3) Prerequisite(s): permission of department. A study of the environmental impact analysis and assessment procedures for transportation improvements. Route location decisions. Noise, air quality, socio-economic, and other impacts.

CEGR 5183. Traffic Engineering Studies. (3) Prerequisite(s): CEGR 3161 and permission of department. Introduction to the traffic engineering studies most used by traffic engineers including data collection techniques, statistical analysis procedures, report writing and presentation. One hour of lecture and three hours of laboratory per week.

CEGR 5185. Geometric Design of Highways. (3) Prerequisite(s): CEGR 3161 and permission of department. Theory and practice of geometric design of highways including intersections, interchanges, parking and drainage facilities. Driver ability, vehicle performance, safety and economics are considered. Two hours of lecture and three laboratory hours per week.

CEGR 5222. Structural Steel Design II. (3) Prerequisite(s): CEGR 3221 and permission of department. Analysis and design of structural steel components and systems with emphasis on theories necessary for a thorough understanding of the design of complete structures. Compression members affected by local buckling, beams with lateral-torsional buckling, continuous beams and beam columns are covered. Welded and bolted connections. Current AISC Specifications used.

CEGR 5223. Timber Design. (3) Prerequisite(s): CEGR 3122 and permission of department. Principles of timber design. Design of simple timber structures subjected to gravity loads and lateral forces. Computation of design loads; formulation of structural systems; design/analyze structural components and connections; structural system analysis of timber structures. Analysis of light commercial and residential structures.

CEGR 5224. Advanced Structural Analysis. (3) Prerequisite(s): CEGR 3122 and permission of department. A continuation of CEGR 3122. Methods to determine deflections in structural members, including moment area, conjugate beam, virtual work, and Castigliano's theorem. Analyze statically indeterminate structures, including approximate method, slope deflection, moment distribution, and matrix stiffness methods. Project to compare analysis techniques and introduce use of structural analysis computer programs.

CEGR 5226. Reinforced Concrete Design II. (3) Prerequisite(s): CEGR 3225 and permission of department. Analysis and design of reinforced concrete components and systems with emphasis on the fundamental theories necessary for a thorough understanding of concrete structures. Concentrically loaded slender columns, slender columns under compression plus bending. Wall footings and column footings. Analysis of continuous beams and frames. Total design project involving the analysis and design of a concrete structure. Current ACI Specifications used.

CEGR 5234. Hazardous Waste Management. (3) Prerequisite(s): CEGR 3141 and permission of department. Integration of scientific and engineering principles with legislation, regulation and technology in the management of hazardous wastes. Study of thermal, chemical, physical and biological systems and processes used in the treatment of hazardous wastes and the remediation of hazardous waste sites.

CEGR 5235. Industrial Pollution Control. (3) Prerequisite(s): Permission of department. Source and characterization of industrial wastewaters, fundamentals of chemical and physical treatment processes, biological treatment technologies, waste minimization and reduction technologies, and sludge handling and toxicity reduction. Implementation of field or laboratory treatability study.

CEGR 5237. Environmental Risk Management. (3) Prerequisite(s): Permission of department. Review of legislation and requirements pertaining to spills and releases of chemicals to the environment. Fundamentals of fires, explosions, toxic emissions and dispersion, hazardous spills, and other accidents. Study of techniques for accident prevention and spill control, and hazardous and risk assessment.

CEGR 5241. Chemical Processes in Water and Wastewater Treatment. (3) Prerequisite(s): CHEM 1252, CEGR 3141, and permission of department. Chemical

principles involved in the treatment of water and wastewaters; principles of chemical equilibrium relevant to natural water systems; the nature and effect of chemical interactions of domestic and industrial waste effluents on natural water systems.

CEGR 5242. Wastewater Treatment Plant Design. (3) Prerequisite(s): Permission of instructor and graduate standing. The design of treatment processes for municipal wastewater treatment plants. Also discusses the basics of physical, biological, and chemical processes and their applications in wastewater treatment.

CEGR 5243. Topics in Environmental Health. (3) Prerequisite(s): CEGR 3141, CEGR 4142, and permission of department. Study of contemporary environmental health problems and practices as they relate to groundwater pollution, food and water-borne diseases, radiological health, occupational health and risk assessment. Provides an introduction to epidemiology and toxicology, and a historical review of federal environmental policy and legislative action.

CEGR 5247. Sustainability. (3) Prerequisite(s): CEGR 3141 and permission of department. Focuses on sustainability as it applies to civil engineering, including land development choices, infrastructure planning, material selection and disposal, energy sources, and water supply and treatment. Methods of assessing sustainability and incorporating sustainable features in design are reviewed.

CEGR 5262. Traffic Engineering. (3) Prerequisite(s): CEGR 3161 and permission of department. Operation and management of street and highway systems. Traffic control systems, traffic flow theory, and highway capacity. Evaluation of traffic engineering alternatives and the conduct of traffic engineering studies.

CEGR 5264. Landfill Design and Site Remediation. (3) Prerequisite(s): CEGR 3258, CEGR 3278, and permission of department. Principles of waste disposal and sanitary landfill siting including design, construction, operation and maintenance. Site assessment of underground storage tank leaks; site remediation, and clean up technologies using choice and economic analysis and computer applications.

CEGR 5270. Earth Pressures and Retaining Structures. (3) Prerequisite(s): CEGR 3122, CEGR 3278, CEGR 4278, and permission of the department. Corequisite(s): CEGR 4278 can be a corequisite. Lateral earth pressure theory and the effects of wall friction, external loads, groundwater, and layered soils; design procedures and construction details associated with selected rigid and modular gravity/semi-gravity walls, mechanically stabilized earth walls, and externally supported structural walls.

CEGR 5271. Pavement Design. (3) Prerequisite(s): CEGR 3161, CEGR 3278, and permission of department. Pavement design concepts and considerations; engineering properties of pavement materials including soils, bases, asphalt concrete, and Portland cement concrete; design of flexible and rigid pavements including shoulders and drainage; computer applications for pavement analysis and design.

CEGR 5272. Design with Geosynthetics. (3) Prerequisite(s): CEGR 3258, CEGR 3278, and permission of department. Pre- or Corequisite(s): CEGR 5278. Introduction to geosynthetic materials, properties, laboratory test procedures, and functions; geosynthetic design methods used for geotechnical, transportation hydraulic, and geo-environmental applications (roadways, walls, slopes, foundation soils, landfills, and dams); the incorporation of geosynthetics for soil reinforcement, separation, filtration, drainage and containment.

CEGR 5273. Engineering Ground Improvement. (3) Prerequisite(s): CEGR 3278 and permission of department. Engineering principles of soil improvement as they relate to applications in both geotechnical and geoenvironmental engineering; innovative techniques to improve soils to meet technical and economic requirements.

CEGR 5274. Site Characterization. (3) Prerequisite(s): CEGR 3278 and permission of department. Site investigation and site assessment technologies employed in geotechnical and environmental engineering; Site investigation planning and various geophysical methods including: seismic measurements, ground penetrating radar, electrical resistivity, and electromagnetic conductivity; Drilling methods for soil, gas and ground water sampling; decontamination procedures; and long term monitoring methods; Conventional and state-of-the-art in situ methods for geotechnical and environmental site characterization: standard penetration test, vane shear test, dilatometer test, pressure-meter test and cone penetration tests. Modern advances in cone penetrometer technology, instrumented with various sensors (capable of monitoring a wide range of physical and environmental parameters: load, pressure, sound, electrical resistivity, temperature, PH, oxidation reduction potential, chemical contaminants).

CEGR 5278. Geotechnical Engineering II. (3) Prerequisite(s): CEGR 3258, CEGR 3278, and permission of department. Design of shallow and deep foundations, including structural considerations; lateral earth pressure theories; design of rigid and flexible earth retaining structures; advanced aspects of slope stability analysis; and computer applications. (*Spring*)

CEGR 5892. Individualized Study and Projects. (1 to 6) Prerequisite(s): permission of department. Individual

investigation and exposition of results. *May be repeated for credit.*

CEGR 5991. Graduate Research in Civil Engineering. (1 to 6) Prerequisite(s): permission of department. Independent study of a theoretical and/or experimental problem in a specialized area of civil engineering. *May be repeated for credit.*

CEGR 6090. Special Topics in Civil Engineering. (1 to 6) Prerequisite(s): Permission of department. Directed study of current topics of special interest. *May be repeated for credit.*

CEGR 6122. Advanced Topics in Structural Steel. (3) Prerequisite(s): CEGR 4222 and permission of department. Theory of plastic-behavior of steel structures; current topics in structural steel.

CEGR 6124. Masonry Design. (3) Cross-listed Course(s): CEGR 8124. Prerequisite(s): CEGR 3225 and permission of department. Introduction of masonry materials and systems, engineering and materials properties and testing procedures. Design of reinforced and unreinforced masonry (clay and concrete) walls, beams, and columns for vertical, wind, and seismic loads. Analysis and design of masonry structures and introduction to computer applications.

CEGR 6125. Structural Strengthening. (3) Cross-listed Course(s): CEGR 8125. Prerequisite(s): CEGR 3221, CEGR 3225, and permission of department. Code requirements for the evaluation of existing structures; analysis of existing structures; performance based design of buildings and bridges; strengthening/retrofit techniques for concrete, structural steel, masonry and timber elements, such as beams, columns, shear/bearing/retaining walls, and slabs; studies of actual strengthening projects using innovative techniques and materials.

CEGR 6126. Analysis of Plates and Shells. (3) Cross-listed Course(s): CEGR 8126. Prerequisite(s): CEGR 4224 and permission of department. Analysis of rectangular and circular plates using classical as well as numerical methods; orthotropic and continuous plates and plate buckling. Analysis of thin shells and shells of revolution with and without bending; membrane theory of cylindrical shells; symmetric and unsymmetric loading; pipes, tanks, and pressure vessels; computer applications.

CEGR 6127. Fracture Mechanics and Fatigue. (3) Cross-listed Course(s): CEGR 8127. Prerequisite(s): CEGR 3221 and permission of department. Introduction to fracture mechanics and fatigue, including Griffith Theory, plane strain-stress conditions, critical stress intensity factors, factors influencing fracture toughness, fracture mechanics design principles, fatigue performance, and fatigue initiation and propagation.

CEGR 6128. Structural Optimization. (3) Cross-listed Course(s): CEGR 8128. Prerequisite(s): CEGR 4224 and permission of department. Introduction to optimization concepts; reformulation of common structural analysis and design problems to an optimization format; optimization of constrained, unconstrained, linear, and nonlinear problems by classical and numerical techniques; and computer applications.

CEGR 6129. Structural Dynamics. (3) Cross-listed Course(s): CEGR 8129. Prerequisite(s): CEGR 3122 and permission of department. Methods for dynamic analysis of single and multiple degree of freedom systems. Topics include: free vibrations, dynamic response of simple structures under time dependent loads (e.g., harmonic, periodic, impulsive, general dynamic loading), support motion, frequency domain analysis, response spectra, earthquake engineering.

CEGR 6141. Water Quality Modeling. (3) Cross-listed Course(s): CEGR 8141. Prerequisite(s): Permission of department. Mathematical modeling of water quality in receiving streams including: generation of point and nonpoint sources of pollution; formulation of transport equations for contaminants in stream and estuarine water; and prediction of the fate, persistence and transformation of chemical pollutants in aquatic ecosystems. Computer model simulation and case studies.

CEGR 6142. Bioenvironmental Engineering. (3) Cross-listed Course(s): CEGR 8142. Prerequisite(s): CEGR 3141 and permission of department. Theoretical principles and design of aerobic and anaerobic biological unit processes for renovating waters and wastewaters. Activated sludge, aerated and facultative lagoons, rotating biological contractors, trickling and anaerobic filters.

CEGR 6144. Environmental Biotechnology. (3) Cross-listed Course(s): CEGR 8144. Prerequisite(s): Permission of department. Application of biotechnology to the management of environmental problems. Study of bioprocess principles, bioremediation of waste disposal sites, cell immobilization technology and innovative biotechnologies.

CEGR 6145. Waste Incineration. (3) Prerequisite(s): Permission of department. Fundamentals of incineration of hazardous/solid wastes. Thermochemical applications and equipment design. Computer modeling of the incineration process and air quality control.

CEGR 6146. Advanced Groundwater Analysis. (3) Cross-listed Course(s): CEGR 8146. Prerequisite(s): Permission of department. Modeling of groundwater flow in saturated and unsaturated zones. Contaminant transport including

advection, dispersion and numerical modeling. Groundwater remediation technology.

CEGR 6147. Watershed Modeling. (3) Prerequisite(s): Permission of department. Characterization of non-point source pollution; modeling of flow and pollutant transport in storm runoff. Watershed modeling in a GIS environment including applications of SWIMM, BASINS, HEC-HMS, HEC-RAS, and NRCS models.

CEGR 6148. Water Conservation. (3) Prerequisite(s): Permission of department. Principles and issues concerning water conservation and methods for effecting water conservation, including residential, industrial, commercial, and agricultural water conservation; water rates, audits and reuse/reclamation as they relate to water conservation; and case studies.

CEGR 6149. Watershed Analysis. (3) Prerequisite(s): Permission of department. Study of NPS problems in urban and non-urban watersheds and from highway runoff. Estimate of sediment yield and design of BMP's including sediment control structures. Introduction to monitoring and modeling of hydrologic systems. Watershed modeling in a GIS environment.

CEGR 6161. Traffic Control and Operation. (3) Cross-listed Course(s): CEGR 8161. Prerequisite(s): CEGR 5161 and permission of department. Traffic control theory and application; traffic regulation, laws and ordinances; speed control, intersection control, flow control and parking control; design and application of control devices, investigation, evaluation techniques; statistical analysis; administration. (*Spring*)

CEGR 6162. Computer Applications for Transportation Engineers. (3) Cross-listed Course(s): CEGR 8162. Prerequisite(s): CEGR 3161 and permission of department. Apply analytical techniques using traffic simulation and transportation planning software to evaluate various transportation facilities; Emphasis on computer applications and software packages such as HCS, SYNCHRO/SimTraffic, and VISSIM; 4-Step planning process using TransCAD; Build mathematical models.

CEGR 6163. GIS for Civil Engineers. (3) Cross-listed Course(s): CEGR 8163. Prerequisite(s): CEGR 2101 and permission of department. Apply Geographic Information System (GIS) tools to solve Civil Engineering problems: add layers, label, and symbolize features, create maps in ArcMap, generate tables and spatial databases, address matching, query and join tables, perform spatial overlays, generate buffers, and conduct spatial analysis. Civil Engineering case studies.

CEGR 6164. Traffic Safety. (3) Cross-listed Course(s): CEGR 8164. Prerequisite(s): CEGR 3161 and permission of department. Crash data elements and source of data; Crash site reconstruction; Quantifying risk; Safety evaluation process: Problem definition, high crash locations, ranking and prioritization, understanding causal factors, countermeasure selection, before-after evaluation; Crash prediction Modeling; Economic appraisal; Safety conscious planning.

CEGR 6165. Urban Systems Engineering. (3) Prerequisite(s): CEGR 3202 and permission of department. Survey of economic, political, sociological and technological factors affecting modern growth; a planning process and its role in solving selected urban problems with emphasis on engineering contributions.

CEGR 6166. Urban Transportation Networks: Operations and Optimization. (3) Cross-listed Course(s): CEGR 8166. Prerequisite(s): CEGR 3161, permission of department, and graduate standing. Introduction to planning and optimization techniques for the analysis of transportation networks. Principles of precise algorithms for finding transport network equilibrium flows and applications that relate to these flows. Topics include: basic optimization skills, shortest path algorithms, user equilibrium, system optimal, elastic demand, OD matrix estimation, network design, congestion pricing, and stochastic user equilibrium.

CEGR 6167. Discrete Choice Modeling. (3) Cross-listed Course(s): CEGR 8167. Prerequisite(s): CEGR 3161, permission of department, and graduate standing. Introduction to elements of the choice process; utility-based choice theory; principles of binary choice models; multinomial logit models; nested logit models; and ordered response models.

CEGR 6171. Air Quality Control. (3) Prerequisite(s): permission of department. Study of various types of air pollutants, their sources, nature and effects. Examination of air quality criteria, standards and monitoring. Analysis of feasibility, applicability and efficiency of diverse systems of control. Evaluation of goal and research needs in the future.

CEGR 6172. Air Dispersion Modeling. (3) Prerequisite(s): permission of department. Atmospheric pollution problems, federal regulations, boundary layer meteorology, dispersion theory, Gaussian model, plume rise formulas, air toxics, and computer modeling of point area, line and mobile sources.

CEGR 6173. Environmental Aquatic Chemistry. (3) Cross-listed Course(s): CEGR 8173. Prerequisite(s): CHEM 3111, CEGR 3141, or equivalent; and permission of department. Concepts of chemical equilibrium applied to natural aquatic systems. Topics include: acid-base reactions, buffer systems, mineral precipitation, coordinate chemistry, redox

reactions, adsorption phenomena and chemical-equilibria computer programs.

CEGR 6181. Traffic Flow Theory. (3) Cross-listed Course(s): CEGR 8181. Prerequisite(s): CEGR 5161 and permission of department. Logical foundations and mathematical representation of traffic flow; interrelation between microscopic and macroscopic equations of motion for highway traffic; stochastic properties of traffic at low and moderate densities. Car-following theories of traffic flow at high densities. Applications of queuing theory.

CEGR 6182. Transportation Systems Analysis. (3) Cross-listed Course(s): CEGR 8182. Prerequisite(s): CEGR 5161 and permission of department. Issues, concepts and methods of transportation systems engineering and planning. Decision making in transportation management. The application of analytical methods to the development and evaluation of transport systems.

CEGR 6183. Intelligent Transportation Systems (ITS). (3) Cross-listed Course(s): CEGR 8183. Prerequisite(s): CEGR 3161 and permission of department. An introduction and overview of Intelligent Transportation Systems (ITS), ITS architecture, advanced technologies for data collection and transportation system management, advanced traveler information systems (ATIS), advanced traffic management systems (ATMS), advanced public transportation systems (APTS), commercial vehicle operations (CVO), electronic toll operations, ITS models and evaluation methods, advanced rural transportation systems (ARTS), and connected/autonomous/driverless vehicles.

CEGR 6222. Experimental Structural Mechanics and Nondestructive Evaluation. (3) Cross-listed Course(s): CEGR 8222. Prerequisite(s): Permission of instructor and graduate standing. A comprehensive overview of experimental techniques used to develop phenomenological understanding of and characterization of solid mechanics, stress analysis, and fracture mechanics problems. Additionally presented are experimental methods routinely employed for nondestructive evaluation of in-service structures, structural components, and structural materials. Students are expected to develop a familiarity with and ability to conduct data acquisition, signal processing, and data interpretation.

CEGR 6223. Introduction to Structures in Fire. (3) Cross-listed Course(s): CEGR 8223. Characteristics of natural and standard fires. Fundamentals of heat transfer in fire. Thermal and mechanical properties and performance of steel, concrete, timber, and fire protection materials and elements at elevated temperatures. Discussion of prescriptive and performance-based codes. Use of finite element software for thermal analysis.

CEGR 6224. Introduction to Power Transmission Structure Designs. (3) Cross-listed Course(s): CEGR 8224. Introduction to the fundamentals of power transmission infrastructure and power grid systems and the stability designs of power transmission structures.

CEGR 6225. Forensic Investigations. (3) Cross-listed Course(s): CEGR 8225. Applying engineering principles and deductive reasoning to the investigation of failures of civil engineering (CE) systems. While structural systems are emphasized, other systems, such as geotechnical or geotechnical/structural systems, are also investigated. Clear and concise communication of findings (field/laboratory investigations), assumptions, and conclusions are required through written reports, projects, and presentations with an understanding of ramifications to the legal process involved in a failure claim. Approximately half of the course involves self-directed research of CE system failures of interest to the student.

CEGR 6226. Structural Systems. (3) Cross-listed Course(s): CEGR 8226. Explores the various types of structural systems, configuration, system determinacy and requirements for static stability, and load flow through the system. Strength and serviceability requirements are only addressed at a conceptual level, since detailed treatment is addressed in material-specific structural design courses (e.g. steel, reinforced concrete, prestressed concrete, masonry, timber). The following key concepts are studied as they pertain to the structural system: vertical load/lateral force types, form/configuration, member and structural component types, connection types and strategies for their usage, and connecting members and structural components together to comprise practical structural systems.

CEGR 6243. Physical Processes in Environmental Systems. (3) Cross-listed Course(s): CEGR 8243. Prerequisite(s): CEGR 3141, CEGR 3143, MATH 2171, and permission of department. Physical processes that describe the behavior of materials in natural and engineered environmental systems including transport, diffusion/dispersion, volatilization, sorption/desorption, flocculation, filtration, and sedimentation.

CEGR 6244. Chemical Fate and Transport. (3) Cross-listed Course(s): CEGR 8244. Prerequisite(s): CEGR 3141 and permission of department. Fate of chemicals in the environment and transport processes within and between phases; Environmental chemo-dynamics; Volatilization, dissolution and adsorption from an equilibrium perspective; Evaluation of mass transfer kinetics across environmental compartments.

CEGR 6245. Chemical and Biological Processes in Environmental Systems. (3) Cross-listed Course(s): CEGR 8245. Prerequisite(s): CHEM 1251, CEGR 3141, and

permission of department. Chemical and biological processes that describe the behavior of materials in natural and engineered environmental systems. Chemical processes to be covered may include acid-base reactions, equilibrium partitioning, pH buffering, precipitation/dissolution, complex formation, adsorption, oxidation-reduction, coagulation, and adsorption. Fundamentals of biological theories to be covered may include kinetics, bioenergetics, genetics, and cellular functions.

CEGR 6251. Foundation Engineering. (3) Cross-listed Course(s): CEGR 8251. Prerequisite(s): CEGR 3278 and permission of department. Methodologies for analysis and design of deep foundations including different construction layouts and configurations (e.g., single and group piles), different installation techniques (e.g., driven, drilled, ACIP, etc.), different loading conditions (e.g., axial compression, axial tension, lateral, general loading, etc), different design approaches (e.g., allowable stress design – ASD, and load and resistance factor design - LRFD), among other topics; New emerging technologies, construction and inspection aspects and their implications on deep foundation design, and other topics.

CEGR 6252. Soil Dynamics and Earthquake Engineering. (3) Cross-listed Course(s): CEGR 8252. Prerequisite(s): CEGR 3122, CEGR 3278, and permission of department. Review of the dynamics of single and multi-degree of freedom systems. Earthquake mechanism, distribution, magnitude, intensity, ground shaking, site effects, prediction, and response spectra. Soil liquefaction; aseismic design of foundations; seismic codes; and machine foundation design.

CEGR 6254. Experimental Soil Mechanics. (3) Cross-listed Course(s): CEGR 8254. Prerequisite(s): CEGR 3278 and permission of department. Experimental methods, with emphasis on laboratory tests, to determine engineering soil properties and investigate soil behavior; 1) classification tests (i.e., used to identify soil classification and identify general engineering behavior type); and 2) assessment of engineering properties, such as permeability, shear strength, stiffness, and compressibility. Primary lab tests to be covered in this course are: consolidation, direct shear, static tri-axial, cyclic tri-axial, cyclic simple shear, resonant column, and other advanced geotechnical laboratory tests. Also includes discussion on field sampling and testing, reconstituted samples, laboratory instrumentation, and measurement techniques.

CEGR 6255. Slope Stability and Earth Structures. (3) Cross-listed Course(s): CEGR 8255. Prerequisite(s): CEGR 3278 and permission of department. Soil and rock slope stability including the aspects of analysis, design, and stabilization within a geotechnical framework; Concepts related to seepage analysis of isotropic and anisotropic soil structures to relate the influence of groundwater conditions in slope stability problems; Presentation of slope stability analysis procedures based on limit equilibrium principles and stress-deformation analyses; Stability considerations of natural slopes and human-made soil structures. Computer software for seepage and slope stability analysis is explained.

CEGR 6261. Traffic Signal Control Systems. (3) Cross-listed Course(s): CEGR 8261. Prerequisite(s): CEGR 6161 and permission of department. Study of control systems for isolated intersections, arterial streets, closed networks, and freeways. Emphasis on computer models; state-of-the-art detection, control, and communications equipment and software; and intelligent vehicle/highway systems.

CEGR 6262. Connected and Autonomous Vehicles. (3) Cross-listed Course(s): CEGR 8262. Prerequisite(s): CEGR 3161. Concepts and basics of connected vehicles (CVs) and autonomous vehicles (AVs), the technology used for CVs and AVs, the CV pilot deployment program and current status of AVs, the impact of CVs and AVs on safety, mobility, and the environment, etc., and existing research on CVs and AVs, as well as conduct literature reviews and case studies involving CVs and AVs.

CEGR 6268. Advanced Soil Mechanics. (3) Cross-listed Course(s): CEGR 8268. Prerequisite(s): CEGR 3258, CEGR 3278, and permission of department. One and two-dimensional consolidation, layered strata effects, and creep; seepage in layered strata, flow net, and seepage forces; shear strength parameters, effective and total stress paths, and application for slope stability evaluation; principles of critical state soil mechanics; computer applications.

CEGR 6891. Graduate Master Project. (3) Prerequisite(s): Permission of department. Individual investigation or exposition of results for the 3-hour Master project.

CEGR 6892. Individualized Study. (3) Prerequisite(s): Permission of department. Individual investigation or exposition of results for the 3-hour study.

CEGR 6990. Industrial Internship. (1 to 3) Prerequisite(s): Completion of 9 credit hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director and requires a mid-term report and final report to be graded by the supervising faculty. *Graded on a Pass/Unsatisfactory basis.* Credit hours gained from Internship shall not be part of the minimum credit hours requirement for graduation.

CEGR 6991. Graduate Master Thesis. (1 to 6)
Prerequisite(s): Permission of department. Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

CEGR 6999. Graduate Master Additional Work. (1 to 3)
Prerequisite(s): Permission of department. Each student initiates or continues an individual investigation culminating in the preparation and presentation of a deliverable (could be part of Master Thesis or Project), upon meeting the 30-credit hour degree requirement. *Graded on a Pass/Unsatisfactory or IP basis. May be repeated for credit.*

CEGR 8090. Special Topics. Directed study of current topics of special interest. *(See the Infrastructure and Environmental Systems heading for details.)*

CEGR 8124. Masonry Design. (3) Cross-listed Course(s): CEGR 6124. Prerequisite(s): CEGR 3225 and permission of department. Introduction of masonry materials and systems, engineering and materials properties and testing procedures. Design of reinforced and unreinforced masonry (clay and concrete) walls, beams, and columns for vertical, wind, and seismic loads. Analysis and design of masonry structures and introduction to computer applications.

CEGR 8125. Structural Strengthening. (3) Cross-listed Course(s): CEGR 6125. Prerequisite(s): CEGR 3221, CEGR 3225, and permission of department. Code requirements for the evaluation of existing structures; analysis of existing structures; performance based design of buildings and bridges; strengthening/retrofit techniques for concrete, structural steel, masonry and timber elements, such as beams, columns, shear/bearing/retaining walls, and slabs; studies of actual strengthening projects using innovative techniques and materials.

CEGR 8126. Analysis of Plates and Shells. (3) Cross-listed Course(s): CEGR 6126. Prerequisite(s): CEGR 4224 and permission of department. Analysis of rectangular and circular plates using classical as well as numerical methods; orthotropic and continuous plates and plate buckling. Analysis of thin shells and shells of revolution with and without bending; membrane theory of cylindrical shells; symmetric and unsymmetric loading; pipes, tanks, and pressure vessels; computer applications.

CEGR 8127. Fracture Mechanics and Fatigue. (3) Cross-listed Course(s): CEGR 6127. Prerequisite(s): CEGR 3221 and permission of department. Introduction to fracture mechanics and fatigue, including Griffith Theory, plane strain-stress conditions, critical stress intensity factors, factors influencing fracture toughness, fracture mechanics design principles, fatigue performance, and fatigue initiation and propagation.

CEGR 8128. Structural Optimization. (3) Cross-listed Course(s): CEGR 6128. Prerequisite(s): CEGR 4224 and permission of department. Introduction to optimization concepts; reformulation of common structural analysis and design problems to an optimization format; optimization of constrained, unconstrained, linear, and nonlinear problems by classical and numerical techniques; and computer applications.

CEGR 8129. Structural Dynamics. (3) Cross-listed Course(s): CEGR 6129. Prerequisite(s): CEGR 3122 and permission of department. Methods for dynamic analysis of single and multiple degree of freedom systems. Topics include: free vibrations, dynamic response of simple structures under time dependent loads (e.g., harmonic, periodic, impulsive, general dynamic loading), support motion, frequency domain analysis, response spectra, earthquake engineering.

CEGR 8141. Water Quality Modeling. (3) Cross-listed Course(s): CEGR 6141. Prerequisite(s): Permission of department. Mathematical modeling of water quality in receiving streams including: generation of point and nonpoint sources of pollution; formulation of transport equations for contaminants in stream and estuarine water; and prediction of the fate, persistence and transformation of chemical pollutants in aquatic ecosystems. Computer model simulation and case studies.

CEGR 8142. Bioenvironmental Engineering. (3) Cross-listed Course(s): CEGR 6142. Prerequisite(s): CEGR 3141 and permission of department. Theoretical principles and design of aerobic and anaerobic biological unit processes for renovating waters and wastewaters. Activated sludge, aerated and facultative lagoons, rotating biological contractors, trickling and anaerobic filters.

CEGR 8144. Environmental Biotechnology. (3) Cross-listed Course(s): CEGR 6144. Prerequisite(s): Permission of department. Application of biotechnology to the management of environmental problems. Study of bioprocess principles, bioremediation of waste disposal sites, cell immobilization technology and innovative biotechnologies.

CEGR 8146. Advanced Groundwater Analysis. (3) Cross-listed Course(s): CEGR 6146. Prerequisite(s): Permission of department. Modeling of groundwater flow in saturated and unsaturated zones. Contaminant transport including advection, dispersion and numerical modeling. Groundwater remediation technology.

CEGR 8161. Traffic Control and Operation. (3) Cross-listed Course(s): CEGR 6161. Prerequisite(s): CEGR 5161 and permission of department. Traffic control theory and

application; traffic regulation, laws and ordinances; speed control, intersection control, flow control and parking control; design and application of control devices, investigation, evaluation techniques; statistical analysis; administration. (*Spring*)

CEGR 8162. Computer Applications for Transportation Engineers. (3) Cross-listed Course(s): CEGR 6162. Prerequisite(s): CEGR 3161 and permission of department. Apply analytical techniques using traffic simulation and transportation planning software to evaluate various transportation facilities; Emphasis on computer applications and software packages such as HCS, SYNCHRO/SimTraffic, and VISSIM; 4-Step planning process using TransCAD; Build mathematical models.

CEGR 8163. GIS for Civil Engineers. (3) Cross-listed Course(s): CEGR 6163. Prerequisite(s): CEGR 2101 and permission of department. Apply Geographic Information System (GIS) tools to solve Civil Engineering problems: add layers, label, and symbolize features, create maps in ArcMap, generate tables and spatial databases, address matching, query and join tables, perform spatial overlays, generate buffers, and conduct spatial analysis. Civil Engineering case studies.

CEGR 8164. Traffic Safety. (3) Cross-listed Course(s): CEGR 6164. Prerequisite(s): CEGR 3161 and permission of department. Crash data elements and source of data; Crash site reconstruction; Quantifying risk; Safety evaluation process: Problem definition, high crash locations, ranking and prioritization, understanding causal factors, countermeasure selection, before-after evaluation; Crash prediction Modeling; Economic appraisal; Safety conscious planning.

CEGR 8166. Urban Transportation Networks: Operations and Optimization. (3) Cross-listed Course(s): CEGR 6166. Prerequisite(s): CEGR 3161, permission of department, and graduate standing. Introduction to planning and optimization techniques for the analysis of transportation networks. Principles of precise algorithms for finding transport network equilibrium flows and applications that relate to these flows. Topics include: basic optimization skills, shortest path algorithms, user equilibrium, system optimal, elastic demand, OD matrix estimation, network design, congestion pricing, and stochastic user equilibrium.

CEGR 8167. Discrete Choice Modeling. (3) Cross-listed Course(s): CEGR 6167. Prerequisite(s): CEGR 3161, permission of department, and graduate standing. Introduction to elements of the choice process; utility-based choice theory; principles of binary choice models; multinomial logit models; nested logit models; and ordered response models.

CEGR 8173. Environmental Aquatic Chemistry. (3) Cross-listed Course(s): CEGR 6173. Prerequisite(s): CHEM 3111, CEGR 3141, or equivalent; and permission of department. Concepts of chemical equilibrium applied to natural aquatic systems. Topics include: acid-base reactions, buffer systems, mineral precipitation, coordinate chemistry, redox reactions, adsorption phenomena and chemical-equilibria computer programs.

CEGR 8181. Traffic Flow Theory. (3) Cross-listed Course(s): CEGR 6181. Prerequisite(s): CEGR 5161 and permission of department. Logical foundations and mathematical representation of traffic flow; interrelation between microscopic and macroscopic equations of motion for highway traffic; stochastic properties of traffic at low and moderate densities. Car-following theories of traffic flow at high densities. Applications of queuing theory.

CEGR 8182. Transportation Systems Analysis. (3) Cross-listed Course(s): CEGR 6182. Prerequisite(s): CEGR 5161 and permission of department. Issues, concepts and methods of transportation systems engineering and planning. Decision making in transportation management. The application of analytical methods to the development and evaluation of transport systems.

CEGR 8183. Intelligent Transportation Systems (ITS). (3) Cross-listed Course(s): CEGR 6183. Prerequisite(s): CEGR 3161 and permission of department. An introduction and overview of Intelligent Transportation Systems (ITS), ITS architecture, advanced technologies for data collection and transportation system management, advanced traveler information systems (ATIS), advanced traffic management systems (ATMS), advanced public transportation systems (APTS), commercial vehicle operations (CVO), electronic toll operations, ITS models and evaluation methods, advanced rural transportation systems (ARTS), and connected/autonomous/driverless vehicles.

CEGR 8222. Experimental Structural Mechanics and Nondestructive Evaluation. (3) Cross-listed Course(s): CEGR 6222. Prerequisite(s): Permission of instructor and graduate standing. A comprehensive overview of experimental techniques used to develop phenomenological understanding of and characterization of solid mechanics, stress analysis, and fracture mechanics problems. Additionally presented are experimental methods routinely employed for nondestructive evaluation of in-service structures, structural components, and structural materials. Students are expected to develop a familiarity with and ability to conduct data acquisition, signal processing, and data interpretation.

CEGR 8223. Introduction to Structures in Fire. (3) Cross-listed Course(s): CEGR 6223. Characteristics of natural and standard fires. Fundamentals of heat transfer in fire.

Thermal and mechanical properties and performance of steel, concrete, timber, and fire protection materials and elements at elevated temperatures. Discussion of prescriptive and performance-based codes. Use of finite element software for thermal analysis.

CEGR 8224. Introduction to Power Transmission Structure Designs. (3) Cross-listed Course(s): CEGR 6224. Introduction to the fundamentals of power transmission infrastructure and power grid systems and the stability designs of power transmission structures.

CEGR 8225. Forensic Investigations. (3) Cross-listed Course(s): CEGR 6225. Applying engineering principles and deductive reasoning to the investigation of failures of civil engineering (CE) systems. While structural systems are emphasized, other systems, such as geotechnical or geotechnical/structural systems, are also investigated. Clear and concise communication of findings (field/laboratory investigations), assumptions, and conclusions are required through written reports, projects, and presentations with an understanding of ramifications to the legal process involved in a failure claim. Approximately half of the course involves self-directed research of CE system failures of interest to the student.

CEGR 8226. Structural Systems. (3) Cross-listed Course(s): CEGR 6226. Explores the various types of structural systems, configuration, system determinacy and requirements for static stability, and load flow through the system. Strength and serviceability requirements are only addressed at a conceptual level, since detailed treatment is addressed in material-specific structural design courses (e.g. steel, reinforced concrete, prestressed concrete, masonry, timber). The following key concepts are studied as they pertain to the structural system: vertical load/lateral force types, form/configuration, member and structural component types, connection types and strategies for their usage, and connecting members and structural components together to comprise practical structural systems.

CEGR 8243. Physical Processes in Environmental Systems. (3) Cross-listed Course(s): CEGR 6243. Prerequisite(s): CEGR 3141, CEGR 3143, MATH 2171, and permission of department. Physical processes that describe the behavior of materials in natural and engineered environmental systems including transport, diffusion/dispersion, volatilization, sorption/desorption, flocculation, filtration, and sedimentation.

CEGR 8244. Chemical Fate and Transport. (3) Cross-listed Course(s): CEGR 6244. Prerequisite(s): CEGR 3141 and permission of department. Fate of chemicals in the environment and transport processes within and between phases; Environmental chemo-dynamics; Volatilization, dissolution and adsorption from an equilibrium perspective; Evaluation of mass transfer kinetics across environmental compartments.

CEGR 8245. Chemical and Biological Processes in Environmental Systems. (3) Cross-listed Course(s): CEGR 6245. Prerequisite(s): CHEM 1251, CEGR 3141, and permission of department. Chemical and biological processes that describe the behavior of materials in natural and engineered environmental systems. Chemical processes to be covered may include acid-base reactions, equilibrium partitioning, pH buffering, precipitation/dissolution, complex formation, adsorption, oxidation-reduction, coagulation, and adsorption. Fundamentals of biological theories to be covered may include kinetics, bioenergetics, genetics, and cellular functions.

CEGR 8251. Foundation Engineering. (3) Cross-listed Course(s): CEGR 6251. Prerequisite(s): CEGR 3278 and permission of department. Methodologies for analysis and design of deep foundations including different construction layouts and configurations (e.g., single and group piles), different installation techniques (e.g., driven, drilled, ACIP, etc.), different loading conditions (e.g., axial compression, axial tension, lateral, general loading, etc), different design approaches (e.g., allowable stress design – ASD, and load and resistance factor design - LRFD), among other topics; New emerging technologies, construction and inspection aspects and their implications on deep foundation design, and other topics.

CEGR 8252. Soil Dynamics and Earthquake Engineering. (3) Cross-listed Course(s): CEGR 6252. Prerequisite(s): CEGR 3122, CEGR 3278, and permission of department. Review of the dynamics of single and multi-degree of freedom systems. Earthquake mechanism, distribution, magnitude, intensity, ground shaking, site effects, prediction, and response spectra. Soil liquefaction; aseismic design of foundations; seismic codes; and machine foundation design.

CEGR 8254. Experimental Soil Mechanics. (3) Cross-listed Course(s): CEGR 6254. Prerequisite(s): CEGR 3278 and permission of department. Experimental methods, with emphasis on laboratory tests, to determine engineering soil properties and investigate soil behavior; 1) classification tests (i.e., used to identify soil classification and identify general engineering behavior type); and 2) assessment of engineering properties, such as permeability, shear strength, stiffness, and compressibility. Primary lab tests to be covered in this course are: consolidation, direct shear, static tri-axial, cyclic tri-axial, cyclic simple shear, resonant column, and other advanced geotechnical laboratory tests. Also includes discussion on field sampling and testing, reconstituted samples, laboratory instrumentation, and measurement techniques.

CEGR 8255. Slope Stability and Earth Structures. (3) Cross-listed Course(s): CEGR 6255. Prerequisite(s): CEGR 3278 and permission of department. Soil and rock slope stability including the aspects of analysis, design, and stabilization within a geotechnical framework; Concepts related to seepage analysis of isotropic and anisotropic soil structures to relate the influence of groundwater conditions in slope stability problems; Presentation of slope stability analysis procedures based on limit equilibrium principles and stress-deformation analyses; Stability considerations of natural slopes and human-made soil structures. Computer software for seepage and slope stability analysis is explained.

CEGR 8261. Traffic Signal Control Systems. (3) Cross-listed Course(s): CEGR 6261. Prerequisite(s): CEGR 6161 and permission of department. Study of control systems for isolated intersections, arterial streets, closed networks, and freeways. Emphasis on computer models; state-of-the-art detection, control, and communications equipment and software; and intelligent vehicle/highway systems.

CEGR 8262. Connected and Autonomous Vehicles. (3) Cross-listed Course(s): CEGR 6262. Concepts and basics of connected vehicles (CVs) and autonomous vehicles (AVs), the technology used for CVs and AVs, the CV pilot deployment program and current status of AVs, the impact of CVs and AVs on safety, mobility, and the environment, etc., and existing research on CVs and AVs, as well as conduct literature reviews and case studies involving CVs and AVs.

CEGR 8268. Advanced Soil Mechanics. (3) Cross-listed Course(s): CEGR 6268. Prerequisite(s): CEGR 3258, CEGR 3278, and permission of department. One and two-dimensional consolidation, layered strata effects, and creep; seepage in layered strata, flow net, and seepage forces; shear strength parameters, effective and total stress paths, and application for slope stability evaluation; principles of critical state soil mechanics; computer applications.

CEGR 8892. Individualized Study. (3) Prerequisite(s): Enrollment in Ph.D. in Civil Engineering program and permission of department. Individual investigation or exposition of results for the 3-hour study. Each doctoral student with Advanced Standing is limited to one individual study class within the 42-credit hour requirement, while each regular doctoral student is limited to two individual study classes within the 72-credit hour requirement. *May be repeated for credit with change of topic or project, and not part of dissertation research.*

CEGR 8893. Research Methods. (3) Prerequisite(s): Enrollment in Ph.D. in Civil Engineering program and permission of department. Prepares graduate students for conducting research in academic and non-academic settings. Teaches students how to find and critically evaluate resources, how to build and test research hypothesis, and how to communicate research results to a variety of audiences in oral and written format.

CEGR 8990. Industrial Internship. (1 to 3) Prerequisite(s): Enrollment in Ph.D. in Civil Engineering program and permission of department. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director and requires a mid-term report and final report to be graded by the supervising faculty. Credit hours gained from Internship shall not be part of the minimum credit hours requirement for graduation. *Graded on a Pass/Unsatisfactory basis.*

CEGR 8991. Doctoral Dissertation. (1 to 6) Prerequisite(s): Enrollment in Ph.D. in Civil Engineering program and permission of department. Individual investigation culminating in the preparation and presentation of a dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.* CE Ph.D. students are required to complete 18 credit hours of dissertation research.

CEGR 8999. Doctoral Dissertation Additional Work. (1 to 3) Prerequisite(s): Enrollment in Ph.D. in Civil Engineering program and permission of department. Students initiate or continue an individual investigation culminating in the preparation and presentation of a deliverable (could be part of doctoral dissertation), upon meeting the 42-credit hour degree requirement. *Graded on a Pass/Unsatisfactory or IP basis. May be repeated for credit.* CE Ph.D. students are required to successfully complete their Dissertation research to graduate with their Ph.D. degree. However, they can only take a maximum of 18 CEGR 8891 credit hours.

Chemistry (CHEM)

CHEM 5090. Special Topics in Chemistry. (1 to 4) Prerequisite(s): Permission of instructor. Selected topics in chemistry. Lecture and/or laboratory hours will vary with the nature of the course taught. *May be repeated for credit.*

CHEM 5095. Topics for Teachers. (1 to 4) Prerequisite(s): Permission of instructor. Selected topics in chemical education. Lecture and/or laboratory hours will vary with the nature of the course taught. *May be repeated for credit.*

CHEM 5111. Instrumental Analysis. (3 to 4) Prerequisite(s): Permission of instructor. Selected modern instrumental methods of analysis, including theory and practice, with considerable attention given to the instrument and elementary electronics involved in the techniques. Two lecture hours and six hours of lab per week.

CHEM 5121. Advanced Inorganic Chemistry. (3 to 4) Prerequisite(s): Permission of instructor. A review of atomic structure and bonding, a survey of the synthesis, structure, and reactivity of the elements and their most important compounds, a discussion of key industrial processes dealing with the preparation of inorganic compounds, and an overview of coordination and organometallic chemistry. Laboratory work involves inorganic preparations and characterization techniques. Three lecture hours and one laboratory period of three hours a week.

CHEM 5133. Methods of Organic Structure Determination. (2) Prerequisite(s): Permission of instructor. Study and application of modern techniques, primarily spectroscopy, to determine the structure of organic molecules. One hour of lecture and one laboratory period of three hours each week.

CHEM 5134. Organic Reaction Mechanisms. (2) Prerequisite(s): Permission of instructor. Mechanistic and theoretical topics which are beyond the scope of CHEM 2131 and CHEM 2132, including orbital symmetry control of organic reactions, the Hammett equation and other linear free energy relationships, heterocyclic compounds, polycyclic aromatic compounds, organic photochemistry, carbenes, nitrenes, arynes and other short lived, reactive intermediates.

CHEM 5135. Concepts and Techniques in Organic Synthesis. (2) Pre- or Corequisite(s): CHEM 5133 or permission of instructor. Modern techniques of organic synthesis. Laboratory includes one or more multi-step syntheses of complex molecules. One hour of lecture and one laboratory period of three hours each week.

CHEM 5165. Principles of Biochemistry I. (3) Prerequisite(s): satisfactory score on an organic chemistry proficiency exam, or permission of instructor. A study of the structures, properties, and functions of biological molecules, bioenergetics of biological reactions, and enzyme catalysis, with particular emphasis on the underlying chemical principles, including thermodynamics and kinetics.

CHEM 5165L. Principles of Biochemistry I Laboratory. (1) Pre- or Corequisite(s): CHEM 5165. Physical properties of biological molecules and an introduction to experimental techniques in biochemical research. Eleven four-hour lab periods.

CHEM 5166. Principles of Biochemistry II. (3) Prerequisite(s): CHEM 5165 with a grade of B or above. A study of various metabolic pathways and information transfer including molecular aspects of cell biology and genetics, with particular emphasis on the underlying chemical reactions, including thermodynamics and kinetics.

CHEM 5167. Structure and Mechanism in Protein Chemistry. (3) Prerequisite(s): CHEM 5165, and either CHEM 5166 or BIOL 5171, or permission of instructor. Examination of structures, properties, and functions of proteins, enzyme catalysis, and bioenergetics, emphasizing underlying mechanistic chemical and biochemical principles.

CHEM 5171. Biochemical Instrumentation. (4) Prerequisite(s): CHEM 5165 and CHEM 5165L with grades of B or above or permission of department. Modern instrumental methods used in biorelated areas such as biochemistry, biotechnology and medical technology. Theory and practice. Potentiometry, spectrophotometry, chromatography, sedimentation, and electrophoresis. Two lecture hours and two three-hour laboratory periods per week.

CHEM 5175. Physical Biochemistry. (3) Prerequisite(s): CHEM 5165, CHEM 5165L, and CHEM 5166 with grades of B or above, or permission of instructor. Colloid systems, equilibria in biological fluids, mass and energy transport in fluids and in association with membranes, energy storage and dissipation with relation to specific chemical bonding, enzyme kinetics.

CHEM 5185. Chemical Fate of Pollutants. (3) Prerequisite(s): Satisfactory score on a chemistry proficiency exam, or permission of instructor. Chemical reactivity and fate of pollutants (in air, water, soil) in terms of their chemical structure and energetics, mechanisms, structure/energy relationships and their interaction with reactive environmental species including light.

CHEM 5200. Computational Chemistry. (4) Pre- or Corequisite(s): Permission of instructor. Electronic and molecular mechanics-based computational methods, including properties, optimized equilibrium and transition state structures and potential energy surfaces of reactions. Three lecture hours and three hours of laboratory each week. Additional projects required of graduate students.

CHEM 6060. Special Topics and Investigations. (1 to 3) Prerequisite(s): Permission of instructor. Directed study of topics of current chemical interest. *May be repeated for credit.*

CHEM 6069. Topics in Biochemistry. (3) Prerequisite(s): CHEM 6165 or permission of instructor. Discussion of

current topics in biochemistry emphasizing their biomedical/biotechnological aspects from a bioinorganic chemistry perspective, bioorganic chemistry, bioanalytical chemistry, biophysical chemistry, biocomputational chemistry, biomaterials. *May be repeated for credit.* Three lecture hours per week.

CHEM 6082. Surfaces and Interfaces of Materials Chemistry. (3) Prerequisite(s): Any three semesters of undergraduate calculus based mathematics (i.e., MATH 1241, MATH 1242, and MATH 2241) and an upper level undergraduate course in thermodynamics (i.e., CHEM 3142, PHYS 3151, or MEGR 3112) or permission of instructor. Theoretical basis, conceptual understanding and experimental investigations of the properties of surfaces and interfaces of various classes of materials will be presented. The content of this course will build from a rigorous derivation of the physical chemistry of surfaces and interfaces to a discussion of topical materials classes and specific materials properties. Three lecture hours each week.

CHEM 6101. Biochemical Principles. (4) Prerequisite(s): Admission to the graduate program or permission of instructor. Molecular biophysics of biological molecules. Bioenergetics of biological reactions and enzyme structure, mechanisms, and regulation. Metabolic pathways and the role of cellular organelles. Biochemical analysis methodology. Thirty-one two-hour lectures.

CHEM 6102. Nanoscale Phenomena. (3) Cross-listed Course(s): NANO 8102, OPTI 6302, and OPTI 8302. Topics include: scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines.

CHEM 6103. Synthesis and Characterization of Nanomaterials. (3) Cross-listed Course(s): NANO 8103. Prerequisite(s): CHEM 6102 or permission of instructor. Topics include: quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organic-inorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres porous silicon, photonic crystals.

CHEM 6115. Advanced Analytical Chemistry. (3) Prerequisite(s): CHEM 5111 with a grade of B or above, or permission of instructor. The application of modern analytical methods to chemical problems. Emphasis is upon chemical information, particularly structural, obtainable from these techniques. *May be repeated for credit.*

CHEM 6125. Theoretical Inorganic Chemistry. (3) Prerequisite(s): CHEM 5121 with a grade of B or above, or permission of instructor. Group theoretical treatment of current theories of inorganic chemistry. Topics include: Ligand field theory, molecular orbital theory for complex ions, electronic spectra of complex ions and the magnetic properties of complex ions.

CHEM 6126. Organometallic Chemistry. (3) Prerequisite(s): Permission of instructor. Recommended Pre- or Corequisite(s): CHEM 5133. Synthesis, structure, characterization, and reactivity of organometallic compounds; introduction to catalysis and bioorganometallic chemistry. Three lecture hours each week.

CHEM 6135. Advanced Organic Chemistry. (3) Prerequisite(s): CHEM 5133 and either CHEM 5134 or CHEM 5135 with grade of B or above, or permission of instructor. A qualitative discussion of modern mechanistic interpretation of the relations between structure and reactivity. Special emphasis is placed on the role of reactive intermediates such as carbocations, carbanions, carbenes, and radicals.

CHEM 6138. Stereochemistry. (3) Prerequisite(s): Advanced course in Biochemistry or Organic Chemistry. Three-dimensional chemistry and its chemical, physical and biochemical consequences, emphasizing classification of isomers and stereoisomers and the consequences of molecular shape on chemical and biological properties.

CHEM 6145. Chemical Thermodynamics. (3) Prerequisite(s): Permission of instructor. The postulatory basis of classical thermodynamics. Problems in chemical thermodynamics. The use of statistical mechanics for calculating thermodynamic functions.

CHEM 6146. Rates and Mechanisms. (3) Prerequisite(s): Permission of instructor. Consideration of chemical kinetics and mechanism schemes, particularly those of current interest.

CHEM 6147. Molecular Photochemistry and Photophysics. (3) Prerequisite(s): Admission to graduate program or permission of instructor. An investigation of the excited states of organic molecules and the photophysics governing radiative and nonradiative transitions. Topics include: electronic orbitals, absorption, emission, potential energy surfaces, energy transfer, photophysical radiationless transitions, singlet oxygen and chemiluminescent organic reactions. Three lecture hours per week.

CHEM 6150. Seminar-Internship. (1 to 3) Prerequisite(s): Permission of instructor. Required for all teaching assistants. Supervised experience in the teaching of college chemistry. *May be repeated for credit.*

CHEM 6155. Polymer Synthesis. (3) Prerequisite(s): Permission of instructor. Polymer structure, classification of polymerization reactions, theory and practice of step growth polymerization, radical, ionic and ring opening polymerizations, polymerization by transition metal catalysts. Recent advances in polymer synthesis. Three lecture hours per week.

CHEM 6165. Advanced Biochemistry. (3) Prerequisite(s): CHEM 6101, BIOL 6102, BIOL 6103, BIOL 6104, or permission of instructor. Advanced course on protein structure, enzyme and mechanistic biochemistry, metabolic biochemistry, biophysical chemistry. Three lecture hours per week.

CHEM 6681. Research Seminar. (1) Prerequisite(s): Permission of instructor. Individual investigation and exposition of the results.

CHEM 6682. Research Seminar. (1) Prerequisite(s): Permission of instructor. Individual investigation and exposition of the results. *May be repeated for credit.*

CHEM 6900. Research and Thesis. (1 to 16) Prerequisite(s): Permission of instructor overseeing thesis research. Laboratory research for the thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

CHEM 8069. Topics in Biochemistry. (3) Prerequisite(s): CHEM 6165 or permission of instructor. Discussion of current topics in biochemistry emphasizing their biomedical/biotechnological aspects from a bioinorganic chemistry perspective, bioorganic chemistry, bioanalytical chemistry, biophysical chemistry, biocomputational chemistry, biomaterials. *May be repeated for credit.* Three lecture hours per week.

CHEM 8101. Biochemical Principles. (4) Prerequisite(s): Admission to Ph.D. program. Molecular biophysics of biological molecules. Bioenergetics of biological reactions and enzyme structure, mechanisms, and regulation. Metabolic pathways and the role of cellular organelles. Biochemical analysis methodology. Thirty-one two-hour lectures.

CHEM 8147. Molecular Photochemistry and Photophysics. (3) Prerequisite(s): Admission to graduate program or permission of instructor. An investigation of the excited states of organic molecules and the photophysics governing the transitions between these states both radiative and nonradiative. Topics include: electronic orbitals, absorption, emission, potential energy surfaces, energy transfer, photophysical radiationless transitions, singlet oxygen and chemiluminescent organic reactions. In this course each student will develop and demonstrate a photochemistry laboratory experiment that illustrates a principle or problem, or new direction of photochemistry. Three lecture hours per week.

CHEM 8155. Polymer Synthesis. (3) Prerequisite(s): Admission to Ph.D. program or permission of instructor. Polymer structure, classification of polymerization reactions, theory and practice of step growth polymerization, radical, ionic and ring opening polymerizations, polymerization by transition metal catalysts. Recent advances in polymer synthesis. Requires a "Research Proposal" which includes a presentation in class as well as a ten page prospectus style manuscript. Three lecture hours per week.

CHEM 8165. Advanced Biochemistry. (3) Prerequisite(s): CHEM 8101, BIOL 8102, BIOL 8103, and BIOL 8104. Advanced course on protein structure, enzyme and mechanistic biochemistry, metabolic biochemistry, biophysical chemistry. Three lecture hours per week.

Child and Family Development (CHFD)

CHFD 5000. Topics in Child and Family Development. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

CHFD 5100. Development: Prenatal to Pre-Adolescence. (3) Prerequisite(s): Admission in Teacher Education for Graduate Certificate in Teaching. The study of development (within the context of family, community, culture, and society) beginning at conception through adolescence. The potential influences of biological, genetic, environmental, and cultural factors on development are explored. Theories and research related to developmental processes are examined. A field-based clinical assignment of approximately 20 hours is required.

CHFD 5114. Collaboration with Diverse Families: Prenatal to 36 months. (3) Prerequisite(s): Admission to Graduate Certificate in Teaching. Examines and applies in-depth research, theory and practices to create and implement evidence-based supports that build upon family and child strengths in a variety of home and community settings. Relationship-based approaches will be embedded throughout the course content. Explores the influence of family and community on the development of infants and toddlers through 30 hours of field-based experience.

CHFD 5200. Child Life: Supporting Children and Families. (3) An overview of the Child Life field, introducing and examining concepts, principles, and applications for the Child Life profession. Students are introduced to the role of the Child Life Specialist in supporting ill children and their

families to promote optimal coping and development. Includes site visits.

CHFD 5250. Assessment of Young Children. (3) Prerequisite(s): CHFD 6230. Corequisite(s): CHFD 6200. Examines effective methods of observation, documentation, and assessment as related to developmental theory for young children, Birth-age 8, who are culturally, linguistically, and ability diverse. A field-based clinical experience is required.

CHFD 6000. Topics in Child and Family Development. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

CHFD 6100. Adjustment Issues: Children in Family Context. (3) Study of adjustment problems of childhood and adolescence with emphasis on the context and patterns of the family-of-origin system that influence behavior and attitudes as children with and without disabilities grow and develop.

CHFD 6102. Learning and Development. (3) Prerequisite(s): Admission to the M.Ed. in Child and Family Studies or the M.A. in Counseling program. In-depth study of selected theories of learning and development.

CHFD 6110. Family-Professional Partnerships. (3) Prerequisite(s): Admission to Teacher Education, GPA of at least 2.5, CHFD 5100, and CHFD 5114. An examination of the principles and practices of family-professional partnerships in terms of research, program implementation, evaluation, and collaboration. In-depth study of developmental designs, supportive programs designed to prevent problems, and programs and organizations which respond to diverse family needs and interests. Emphasis is placed on the process of family involvement, communication, and collaborative leadership.

CHFD 6115. Child and Family Advocacy. (3) Prerequisite(s): CHFD 6102. Study of the principles and practices of child and family advocacy.

CHFD 6120. Creativity, Learning Environments and Experiences. (3) Investigation of theories of creativity and their relationship to curriculum development.

CHFD 6130. Concepts of Teaching and Learning: Children's Play. (3) Examination of theories, trends and current practices in children's play.

CHFD 6200. Curriculum and Learning Environments for Young Children. (3) Prerequisite(s): Prerequisite(s): Admission to Graduate Certificate in Teaching, CHFD 5100, and CHFD 6230. Examines theoretical and research foundations for designing, implementing, adapting, and evaluating curriculum that is responsive to the needs of young children who are culturally, linguistically, and ability diverse. Observational strategies are used to assess both the child (individual, sociocultural, and developmental characteristics) and the environment in order to identify best practices.

CHFD 6210. Inclusive Education for Young Children. (3) Pre- or Corequisite(s): CHFD 6102. Inclusive education provides the opportunity for children with and without developmental disabilities to learn together. Inclusive early childhood curricula and instructional strategies are emphasized as is the professional role of interdisciplinary team member. Legislative mandates for inclusion are studied.

CHFD 6220. Family Theory and Research. (3) Pre- or Corequisite(s): CHFD 6102. Study of family theories and research which employ the contextual framework of the family as a system and which explain family of origin, family functioning, family structure, and family process. Application of theory and research will include an understanding of the various levels of family functioning as a model for developing family support and intervention plans.

CHFD 6230. Emerging Literacy and Mathematical Understanding. (3) Prerequisite(s): Admission to Graduate Certificate in Teaching. Examines the development of language, literacy, and mathematical thinking in young children who are culturally, linguistically, and ability diverse. Research, current educational practice, and instructional materials and strategies are analyzed. Emphasis is on the design and assessment of integrated listening, speaking, reading, writing, and mathematical activities.

CHFD 6240. Advanced Studies in Infant and Child Development. (3) Prerequisite(s): CHFD 6102. An advanced course to extend knowledge of infant and early years development of typically and atypically developing children. Developmental domains of infants and young children and their relationships within family and society is emphasized.

CHFD 6300. Evidence-Based Practices in Child and Family Studies. (3) Prerequisite(s): Admission to the M.A.T. in Child and Family Studies: Early Childhood Education (B-K). Investigates evidence-based practice guidelines, methods, and outcomes in assessment, intervention, instruction, and evaluation outcomes and/or policies that support child development in the context of families and communities.

CHFD 6330. Action Research Development and Proposal. (3) Prerequisite(s): CHFD 6300. Corequisite(s): RSCH 6101. Introduces candidates to action research in the context of self-reflective inquiry in candidates' own practice with strategies to improve practice. Fundamentals of the action

research process including theoretical context, methods of collecting, analyzing, and describing data to prepare candidates to develop a proposal and conduct action research independently.

CHFD 6400. Student Teaching Seminar: B-K Child and Family Development. (6) Prerequisite(s): Approval of an Application for Student Teaching and departmental approval. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

CHFD 6800. Individual Study in Child and Family Studies. (1 to 6) Prerequisite(s): A written plan of study approved by the student's advisor and the individual study director. Designed to allow a student to pursue specialty interests under the supervision of an appropriate faculty member. Permission of the student's advisor and appropriate individual study director. *May be repeated for credit.*

CHFD 6900. Research in Child and Family Studies (Master's Thesis). (3) Prerequisite(s): RSCH 6101 and completion of at least 24 hours of graduate program. Design, implementation, presentation, and evaluation of an approved thesis in the student's specialty area. The thesis is of the student's own design under the supervision of an advisor and graduate committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

CHFD 7135. Readings in Learning and Development. (3) Examines research data about the development of human behavior interpreted in terms of multiple disciplines, including psychology, anthropology and ethnology.

CHFD 7400. Applied Leadership in Child and Family Studies. (3) Prerequisite(s): Completion of at least 30 credit hours of graduate program. An intensive, professional supervised field-based experience in which students demonstrate the ability to provide direct service, to apply research and theory in a field-based setting, and to assume leadership roles. A minimum of 200 clock hours is required.

CHFD 7600. Leadership in Child and Family Studies. (3) Prerequisite(s): CHFD 6300, CHFD 6330, RSCH 6101, and completion of at least 24 credit hours of the graduate program. Corequisite(s): CHFD 7691. A synthesizing course of study focusing on review, compilation, analysis, and evaluation of the literature, research, and experiences relevant to the student's specialty area. Students demonstrate leadership by conducting a program evaluation, creating innovative solutions to challenges, and initiating and creating collaboration among persons and across agencies.

CHFD 7691. Project Implementation in Child and Family Studies. (2) Prerequisite(s): CHFD 6300, CHFD 6330, RSCH 6101; completion of at least 24 credit hours in the M.Ed. in Curriculum and Instruction; and committee-approved action research proposal. Corequisite(s): CHFD 7600. Focuses on the implementation and analysis of the approved action research proposal. Candidates demonstrate leadership by creating innovative solutions to challenges and initiating and creating collaboration among persons and within an agency that serves children and families.

Criminal Justice and Criminology (CJUS)

CJUS 5000. Topics in Criminal Justice and Criminology. (3) Specialized topics in criminal justice and criminology. *May be repeated for credit.*

CJUS 5101. Drugs, Crime, and the Criminal Justice System. (3) Provides an overview of the current state of drug use in this country and throughout the world and examines the nature and extent of drug use, the history of drug use/abuse, contemporary drug use patterns, licit and illicit drug dealing and trafficking, crime and violence associated with drug use and drug markets, drug control strategies at the local, state, national and international level, treatment level, treatment options and alternatives, drug policy issues, legalization debates, and prevention strategies.

CJUS 5103. International Criminal Justice. (3) Examination of the patterns and trends in international crime such as terrorism, transnational organized crime, and trafficking in people and a review of how the legal traditions of common law, civil law, Islamic law and socialist legal systems are structured and function criminal justice systems of the United States and other nations.

CJUS 5160. Victims and the Criminal Justice System. (3) Relationship between victims of crime and the criminal justice system. Specific topics include an analysis of the characteristics of crime victims, victim reporting patterns, treatment of victims by the various segments of the criminal justice system, victim assistance programs, and the issue of compensation and/or restitution for victims of crime.

CJUS 5161. Violence and the Violent Offender. (3) Issues surrounding violence in today's society and their impact on offenders involved in homicide, child and domestic abuse, and other forms of violence. Examination of myths about violence, victim-offender characteristics and relationships, and theories of violence.

CJUS 5162. Sexual Assault. (3) Comprehensive and critical examination of sexual exploitation in the United States.

CJUS 6000. Topics in Criminal Justice. (3 to 6) Specialized criminal justice topics. *May be repeated for credit.*

CJUS 6101. Criminological Theory and Policy. (3) Definitions and patterns of criminal behavior. Major theoretical perspectives on crime, including historical, philosophical, individual, community-oriented and societal approaches. Particular focus on the development of policy and the effectiveness of current policies aimed at reducing crime.

CJUS 6102. Research Methods and Design. (3) Introduction to research methodology and statistics with emphasis on applications to criminal justice settings. Topics include: problem selection, theory, hypothesis formulation, research design, sampling, measurement, and proposal writing.

CJUS 6103. Introduction to Data Analysis. (3) Advanced research methodology with emphasis on conducting, presenting, and evaluating research in criminal justice settings. Topics include: data collection, data input, data analysis, and interpretation.

CJUS 6104. Legal and Ethical Issues in Crime Analysis. (3) Examines how the law functions as a powerful tool of social control in our society. Particular emphasis is given to understanding the constitutional limitations placed on the construction of law, the elements of criminal offenses, and criminal defenses. Also focuses on the more recent issues to arise out of the use of big data systems and privacy.

CJUS 6105. Criminal Justice Seminar. (1) An introduction to the criminal justice faculty, their research areas of expertise, and the type of projects with which they are currently involved.

CJUS 6106. Introduction to Crime Analytics and Informatics. (3) Introduction to the process of discovering and disseminating patterns of criminological data in order to improve the criminal justice system and the delivery of services in the system. Topics include: data mining, analysis of big data, geospatial analytics, and text analysis.

CJUS 6120. Criminal Justice Management and Decision-Making. (3) Application of generic principles of management and supervision to operational problems confronted by criminal justice agencies with particular attention to decision- making and discretion in criminal justice settings.

CJUS 6130. Law Enforcement Systems. (3) Consideration of the elements of law enforcement agencies as subsystems of the total criminal justice system. Comparisons of law enforcement systems in other countries is also considered.

CJUS 6131. Police Problems and Practices. (3) Research on current issues in law enforcement with emphasis on the legal, social, and institutional contexts in which they occur.

CJUS 6132. Legal Issues in Law Enforcement. (3) Law applicable to the functions of police administrators and line police officers including constitutional, statutory, judicial, and administrative law governing search and seizure, arrest, interrogation, use of force, jurisdiction, civil and criminal liability of administrators and officers, and the rights of officers and suspects.

CJUS 6140. Prosecution and Adjudication Processes. (3) Functions and powers of prosecutors, defense attorneys, judges and juries including plea bargaining and court procedure.

CJUS 6150. Corrections. (3) Functions of correctional agencies, principles of punishment and a historical analysis of correctional institutions and programs including prisons, jails, probation and parole systems.

CJUS 6151. Correctional Strategies: Rehabilitation and Reintegration. (3) Efforts to change offender behavior and to facilitate the development of offender- community linkages. Institutional classification and treatment strategies, pre-release and temporary release programs, innovative uses of probation and parole systems, community residential programs and new dispositional models; e.g., sentencing to community service and restitution.

CJUS 6152. Legal Issues in Corrections. (3) Major legal issues pertaining to corrections, including sentencing, probation, restitution, prisons, parole, pardon and restoration of rights with emphasis on legal issues often confronted by correctional administrators and probation and parole personnel.

CJUS 6160. Juvenile Justice Systems. (3) The process by which specific behaviors are identified as delinquent and the responses of the juvenile justice system to such behaviors. Laws dealing with the juvenile justice system, the historical development of the system, and the effectiveness of innovative responses to delinquency.

CJUS 6170. Program Planning and Evaluation in Criminal Justice. (3) Applied research as a foundation for criminal

justice planning and evaluation. Emphasis on the interrelationship of planning and evaluation within program management.

CJUS 6171. Geospatial Analytics and Crime. (3) Familiarizes students with ArcGIS software and the visualization of geographically oriented data. Students work through assignments and projects aimed at helping them understand how to think about a problem spatially and create maps and visualizations that help answer these problems. The final project connects them to outside agencies to help the agency better understand a problem with which they are dealing.

CJUS 6172. Intelligence Analysis. (3) Examines intelligence analysis at the Federal, State, and Local levels, and how analytic strategies can be employed to analyze quantitative and qualitative data of interest to those operating in the national security environment.

CJUS 6174. Data Visualization. (3) Students (1) learn basic visualization design principles; (2) identify and analyze misleading charts and visualization; (3) become proficient in using visualization techniques to effectively and efficiently present multivariate, temporal, text, geospatial, and hierarchical data; (4) create a poster presentation suitable for presentation at a research conference; and (5) create a poster presentation suitable for presentation at a community forum.

CJUS 6400. Graduate Internship. (3 or 6) Prerequisite(s): Permission of instructor. The internship provides information, guidance, and work experience in a core area/discipline of the criminal justice and related fields. It provides students with an opportunity to gain valuable work experience, make contacts with local agencies, and build their skill set. Students attain knowledge in professionalism, ethics, interviewing, and resume building. Finally, the course project includes the development and presentation of an original research project conducted in conjunction with the agency. *May be repeated for credit up to 6 credit hours.*

CJUS 6800. Directed Individual Study in Criminal Justice. (1 to 6) Supervised investigation of a criminal justice problem of special interest to the student. *May be repeated for credit one time with permission of student's major professor or academic committee.*

CJUS 6901. Thesis I. (3) Students work on developing a research proposal of a significant criminal justice topic approved by the student's thesis committee. The final proposal includes an extensive literature review and a detailed discussion of the research plan. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

CJUS 6902. Thesis II. (1 to 3) Prerequisite(s): CJUS 6901. Students conduct independent research developed in CJUS 6901, successfully defend the research in an oral defense meeting, and have the final written thesis approved by the graduate school. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

CJUS 6903. The Applied Research Project. (3) Prerequisite(s): must pass the qualifying examination, have a research project and human subjects approval, where necessary. Students develop a major paper on a topic of criminal justice importance. It is designed to be completed within one semester. This project is typically designed for research in agencies within the community and must be successfully defended in an oral defense meeting. It is geared towards the terminal Master's student and not appropriate for those seeking the doctorate. *Graded on a Pass/Unsatisfactory basis.*

Construction and Facilities Management (CMET)

CMET 5000. Special Topics - Construction Management. (1 to 4) Cross-listed Course(s): CMET 4073. Prerequisite(s): Permission of department. A study of new and emerging technical topics pertinent to the field of construction management.

CMET 5126. Project Scheduling and Control. (3) Methods for planning, scheduling, and controlling construction projects, emphasizing manual and computer-based techniques for critical path method scheduling, resource management, construction cost control, and reporting practices.

CMET 5135. Building Information Modeling. (3) The creation, management, and application of building information models to the construction, operation, and maintenance of a facility. Focus on 3D and 4D computer models of building components, renderings, animations, and interfacing with analysis tools.

CMET 5140. Building Energy Management. (3) Prerequisite(s): ETCE 3271, ETME 3143, or permission of instructor. Integrated planning of energy efficient technologies for building environmental control systems. Introduction to the design, planning, and optimization of HVAC systems and technology needed to integrate the heating, cooling, natural ventilation, lighting, electricity, and building energy management systems into a building's structure and design.

CMET 5150. Green Building (3) Sustainable design and construction. Topics include: sustainable sites, water

efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation in design, and regional priority.

CMET 5160. Advanced Construction Materials. (3)
Materials utilized in concrete, concrete construction, and quality control. Study of concrete properties and the variables that affect them. Topics also include: destructive and non-destructive testing of structural concrete, service life prediction models, and preventative measures, as well as recent advances in concrete materials, construction, and technology.

CMET 5290. Temporary Structures in Construction. (3)
Prerequisite(s): ETCE 3163 or permission of instructor. Temporary structures used to support construction operations such as concrete formwork, scaffolding systems, shoring systems, cofferdams, underpinning, slurry walls, and construction dewatering systems.

CMET 5350. Construction Geotechnics and Foundations. (3) Study of the concepts and fundamental principles of construction geotechnics related to foundation engineering/construction excavations, temporary structures, dewatering and slope stability.

CMET 6000. Special Topics in Construction and Facility Management. (3) Study of specific new areas emerging in the various fields of construction and facility management. *May be repeated for credit.*

CMET 6135. Advanced Construction Planning and Management. (3) Prerequisite(s): CMET 4126 or permission of instructor. Advanced methods for planning and controlling construction projects. Specific topics of study include resource allocation, leveling and management, critical path method (CPM) and project evaluation and review techniques (PERT) of scheduling, project controls through cost-schedule integration, and schedule compression.

CMET 6145. Facilities Management Financial Analysis. (3)
Prerequisite(s): ETGR 3222, ECON 2102, or permission of instructor. Real property concepts, issues, and topics pertinent to the facility management professional to include fundamentals of commercial real estate investment, understanding market influences, contracts and property portfolio management.

CMET 6155. Facility Instrumentation and Controls. (3)
Prerequisite(s): ETME 3163 or permission of instructor. Design and analysis of industrial process control instrumentation. Topics include: process control devices and process control applications associated with industrial instrumentation and building and facility operation.

CMET 6160. Research and Analytical Methods. (3)
Prerequisite(s): STAT 1220 or permission of instructor. Analytical and research techniques applicable to construction and facility management problems. Topics of study include defining research problems, experiment design, measurement, sampling, and analysis.

CMET 6165. Transportation Asset Management. (3)
Management and planning techniques for transportation infrastructure assets. Focus on recent advances for maintaining and managing transportation assets, including performance management, prioritization of maintenance strategies, network and project level optimization.

CMET 6180. Alternative Project Delivery Methods. (3)
Prerequisite(s): CMET 3224 or permission of instructor. Study of the many organizational arrangements between construction owners, designers, contractors, and financiers. Delivery methods studied include design-bid-build (DBB), design-build (DB), construction management (agency CM and CM@Risk), design-build-operate (DBO), and design-build-finance-operate (DBFO).

CMET 6240. Safety and Risk Management. (3) Causes and prevention of industrial accidents, hazardous processes and material, OSHA regulations and requirements, and design of accident prevention programs.

CMET 6250. Asset Management for Facility Managers. (3)
Prerequisite(s): CMET 6270 or permission of instructor. Study of useful life of building and infrastructure systems and creating a process to manage their life cycles; emphasis on justifying and funding capital projects.

CMET 6255. Advanced Plant Layout and Design. (3)
Prerequisite(s): CMET 6270 or permission of instructor. Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization.

CMET 6270. Operation of Constructed Facilities. (3)
Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements.

CMET 6275. Advanced Construction Means and Methods. (3) Construction means, methods, and equipment used to transform a particular design concept into a completed usable structure or facility. Emphasis is placed on current and innovative construction techniques and equipment.

CMET 6285. Quality Assurance in Construction. (3)
Prerequisite(s): CMET 6160 or permission of instructor. The principles and applications of quantitative methods of quality control to production processes with an introduction to process control charts, Pareto charts, and other quality analysis tools for the construction industry.

CMET 6295. Design and Improvement of Construction Operations. (3) Prerequisite(s): CMET 6135. Design of construction operations based on productivity concepts. Techniques for collecting data, analyzing, and formulating solutions to improve construction operations is emphasized.

CMET 6800. Independent Study in Construction and Facility Management. (3) Prerequisite(s): Permission of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction and facility management. *May be repeated for credit.*

CMET 6900. Master's Thesis and Research. (1 to 6) Prerequisite(s): permission of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

Communication Studies (COMM)

COMM 5115. Seminar in Health Communication. (3) Course provides in-depth examination of a major area of health communication utilizing extensive readings, discussion and written work.

COMM 5141. Advanced Organizational Communication. (3) Critical examination of the communication practices of organizations which accomplish such tasks as establishing organizational identification, influencing organizational members, and making decisions. Includes application of research methods to assess and analyze an organization's communication practices.

COMM 5147. International Public Relations. (3) Examines the complexities of public relations practice in an international setting. Includes overview of the factors that complicate communication across cultures and borders and an examination of the effect those factors have on public relations practice in specific global regions.

COMM 6000. Topics in Communication Studies. (3) Intensive investigation of a timely and important topic in communication studies. The topic of investigation may vary from semester to semester. *May be repeated for credit with permission of graduate advisor.* Topics courses include: Public Relations Issues Management, Public Relations Theory, Facilitating Corporate Social Responsibility, Integrated Communication, Sports & Rhetoric, and Fundraising.

COMM 6011. Topics in Communication Research Methods. (3) Prerequisite(s): COMM 6100 or permission of instructor. Focused and advanced instruction on a specific data analytic methodology relevant to communication studies. Sample foci may include—but are not limited to—focus groups, textual analysis, regression, interviewing, structural equation modeling, ethnographic analysis, hierarchical linear modeling. *May be repeated for credit with permission of graduate advisor.*

COMM 6100. Communication Research Methods. (3) Methods for systematic investigation of communication behavior. Theoretical and practical applications of both qualitative and quantitative research methodologies are utilized for completion of original projects.

COMM 6101. Contemporary Viewpoints in Communication Theory. (3) A survey of the leading theoretical traditions in communication studies. Covers both qualitative and quantitative approaches to conceptualizing communication practices.

COMM 6102. Professional Seminar in Communication. (3) Examination of the academic study of communication. Investigates the role of paradigms and use of the scholarly method. Students develop a scholarly project through a seminar approach.

COMM 6103. Communication Ethics. (3) Discussion and analysis of inherently ethical elements of communication praxis in public, community, institutional and organizational domains. Exploration of practical, philosophical and theoretical concerns that affect everyday matters of moral choice and judgment.

COMM 6110. Advanced Persuasion. (3) Analysis of theories of persuasion as a mode of social influence. Focus on the understanding and analysis of how persuasion works in various communicative contexts including mass-mediated, public relations, organizations and public advocacy.

COMM 6120. Communication and Network Society. (3) Examines the social dynamics arising from the global embrace of revolutionary communication technologies. Topics include: the forces that shape new information flows and the effects emergent technologies exert across nations, local communities and individuals.

COMM 6121. Communication and the Internet. (3) Considers the Internet as a social, cultural and political phenomenon. Studies and debates the competing visions of how the Internet does, can and should play a role in reshaping society. Explores how the computer and network technologies shape communities as well as individual identities. Addresses questions of law and public

policy connected to issues of access, intellectual property and censorship.

COMM 6130. Rhetorical Criticism. (3) The application of qualitative methods of language and rhetorical analysis to communication artifacts. A seminar approach to learn close textual analysis. Methodologies include dramatism, situational analysis, genre, metaphor, perspectival and postmodern paradigms.

COMM 6141. Organizational Communication Case Studies. (3) Communication theories are applied to real and fictional organizational cases. Topics such as culture, diversity, change, networks, and diffusion of innovations are examined from a communication perspective.

COMM 6142. Seminar in Organizational Communication. (3) Using a seminar approach, this course surveys the theoretical approaches to the study of organizational behavior from a communication perspective. Focuses on issues of communication, roles and leadership.

COMM 6143. Organizations and Communication Technology. (3) The theories and concepts of how communication and technologies interact to shape organizational structures and communication processes.

COMM 6145. Communication Campaign Management. (3) A blending of theory and application to public relations/communication campaigns. The application dimension stresses mastery of the technical aspects of the campaign: research, problem-solving, planning, evaluation, and teamwork. The theoretical dimension stresses the study of actual campaigns and formulating generalizations regarding their successes or shortcomings. Class members serve on account teams with the instructor as manager. Account teams represent real-world clients and prepare a campaign book for the client's later implementation.

COMM 6146. Media Relations. (3) Draws on academic and professional research to study the communication strategies and tactics associated with establishing and maintaining effective relations between public relations practitioners and the media.

COMM 6410. Professional Communication Studies Internship. (3, 6) Prerequisite(s): Enrollment in M.A. or Graduate Certificate in Communication Studies program. Students work 10 hours per week for 3 credit hours, or 20 hours per week for 6 credit hours in an approved placement. *May be repeated for credit in the same or a different internship placement with permission of Graduate Program Director. Graded on a Pass/Unsatisfactory basis.* Does not count toward the required 30 credit hours of graduate work for the M.A. degree or graduate certificate.

COMM 6880. Independent Study. (3) Prerequisite(s): Permission of instructor and Graduate Program Director. Area of study beyond the scope of current offerings to be devised by student and faculty member. *May be repeated for credit.*

COMM 6995. Directed Project in Communication. (3 or 6) Design, implementation, presentation and evaluation of an approved applied research project in student's specialty area. The Directed Project is of the student's own design under the supervision of a research advisory committee. *May be repeated with permission of Graduate Program Director, if taken for three hours credit.* Six hours of Directed Project may be taken during a single semester.

COMM 6999. M.A. Thesis. (3 or 6) Appropriate research and written exposition of that research is required. The Thesis is proposed and defended under the supervision of a research advisory committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

Counseling (CSLG)

CSLG 6000. Topics in Counseling. (1 to 6) May include classroom and/or clinic experiences in the content area. *May be repeated for credit with permission of department.*

CSLG 6100. Counseling Theories. (3) Examination of the counseling relationship from various theoretical frameworks, including client-centered, psychoanalytic, Gestalt, transactional analysis, rational emotive, reality, and behavior theories.

CSLG 6101. Ethical and Professional Issues in Counseling. (3) Ethical and legal responsibilities, ethical standards, interpretations of laws by local authorities, and court decisions that impact the counseling profession. Skills of practical, ethical, and legal consultation are also emphasized.

CSLG 6104. Counseling Across the Lifespan. (3) Examines major theories of human development across the lifespan from psychological, emotional, cognitive, physical, social and moral perspectives. In addition, a framework for understanding sociocultural, situational, environmental factors that impact individuals, families and communities is provided. Specific counseling methods and techniques that can be utilized in an integrated approach to help individuals and families address developmental challenges are integrated throughout the course.

CSLG 6109. Research in Counseling. (3) Examination of principles and practices for research and development of programs in counseling with emphasis on developmental

designs, preventive programs, objectives and organizations.

CSLG 6110. Counseling Techniques. (3) Examination of concepts of individual counseling and the means for establishing facilitative relationships including competence in basic counseling skills and interventions.

CSLG 6111. Advanced Counseling Techniques. (3) Prerequisite(s): CSLG 6100 and 6110. Counseling interventions useful in facilitating client change and growth from an action-oriented, problem management perspective. Strategies for cognitive, affective, and behavioral change will be practiced.

CSLG 6115. Person-to-Person Relationships. (3) Examination of concepts and methods for improving human relationships. This course has an experiential component.

CSLG 6120. Group Counseling. (3) Investigation of concepts of group counseling and the means for developing facilitative interaction in groups which includes an experiential component as a major learning activity.

CSLG 6121. The Leadership and Design of Structured Groups. (3) Methods of creating psychoeducational groups. Focus on applying psychological theories to the selection of group content. Leadership issues such as screening, dealing with difficult members, and leader roles are addressed.

CSLG 6145. Multicultural and Social Justice Counseling. (3) Multicultural and social justice perspectives are crucial to effective and ethical practice in the counseling profession. In this course, students develop the knowledge, skills, and awareness for multicultural and advocacy competence to help them be more effective in assisting diverse clients and supporting communities (especially at-risk and vulnerable populations).

CSLG 6150. Career Development and Counseling. (3) Designed to help counselors and/or career educators develop skills to use career theory and information with an emphasis on understanding individual lifestyle development, career education over the life span, and supportive career counseling.

CSLG 6152. Approaches to Career Development (K-12). (3) Counselors and vocational development coordinators gain an understanding and skills necessary for (1) the development, management and evaluation of a comprehensive, competency-based K-12 career education/ counseling program, (2) infusing career education into K-12 curriculum in a counselor/consultant capacity, and (3) establishing and leading successful individual and group career development activities.

CSLG 6153. Diagnosis and Treatment in Counseling. (3) Cross-listed Course(s): CSLG 8153. Prerequisite(s): Graduate standing in M.A. in Counseling program. Developing diagnostic skills using the *Diagnostic and Statistical Manual of Mental Disorders (DSM-V)* multi-axial classification system for mental and emotional disorders. Provides an overview of theory, research, and practice related to diagnosis and treatment. Diagnostic criteria is studied with a sensitivity to cultural and ethnic issues.

CSLG 6154. Couples Counseling. (3) Surveys relevant theories of marriage and family therapy related to counseling couples. The major emphasis is on basic relationship processes, including healthy couple functioning, communication, developmental sequences, family of origin issues, intimacy, sexuality and conflict. Treatment planning and therapeutic strategies for specific couple problems such as divorce, marital affairs, and domestic violence are addressed. The objectives for this course are accomplished through assigned readings, seminar discussions, small group work, role plays, lectures, case presentations, audiovisual materials, guest speakers, and student assignments.

CSLG 6160. Theories of Addiction. (3) Introduction to the theoretical, philosophical, and historical premises upon which addiction is explained and treatment and prevention are based. Biological, psychological, and sociological etiologies of substance use and related addictive disorders are studied.

CSLG 6161. Assessment and Diagnosis of Addictive Disorders. (3) Process and procedures for professional biopsychosocial assessment and diagnosis of substance use and related addictive disorders in adolescents and adults. Implications of addiction for clients and their families are addressed.

CSLG 6162. Interventions in Addiction Counseling. (3) A counseling techniques course designed to help students who have worked as professional addiction counselors and those who have little or no experience working with addicted individuals and their families.

CSLG 6163. Treatment Planning and Relapse Prevention in Addiction Counseling. (3) An introduction to the principles and practices upon which addiction treatment and relapse prevention are based. Students gain practical experience in assessment, diagnosis, treatment planning, and relapse prevention planning with addicted clients.

CSLG 6164. The McLeod Institute on Addiction. (3) Cross-listed Course(s): CSLG 8164. A hybrid course delivered through a combination of independent learning, self-directed study, attending the McLeod Institute on Addiction conference, and completing all required course assignments by end of Summer Session I. The McLeod

Institute on Addiction is a conference offered annually during the third week in May. The topics vary yearly and are designed to provide both broad and specific knowledge germane to addiction counseling. *May be repeated for credit.*

CSLG 6200. Introduction to Theories of Family Counseling. (3) Examination of appropriate interventions in working with families focusing on major theorists and techniques in the field.

CSLG 6201. Counseling Needs of Women. (3) Women's development and needs, the problems they bring to counselors, strategies for helping with them, myths about women and biases in psychological research.

CSLG 6202. Counseling Military Families and Children. (3) Cross-listed Course(s): CSLG 8202. Provides the opportunity to learn about the unique culture of military families and children. Specific challenges and stressors they encounter while serving in the U.S. Armed Forces are thoroughly addressed. Some of the topics explored include: characteristics of active duty personnel; National Guard and Reserve members; military children; stages of deployment; and various social, emotional, physical, and mental health concerns. Students completing this course also learn about evidence-based approaches and interventions, and develop a more in-depth understanding of how to work effectively with this specific population.

CSLG 6204. Counseling Military Veterans. (3) Cross-listed Course(s): CSLG 8204. A comprehensive overview of issues impacting military veterans. Specific cultural factors such as race, gender, and sexual orientation are also taken into consideration. Topics include: career transitions, family matters, mental health stigma, traumatic brain injury, suicide, PTSD, depression, homelessness, and addiction. Resilience and strength of military veterans is also addressed. In addition, students learn about evidence-based techniques, strategies, and approaches utilized to work effectively with military veterans.

CSLG 6205. Counseling Older Adults. (3) Introduction to counseling adults over age 60 with a focus on positive aging. Explores characteristics of the older adult population and current issues and challenges they face (e.g., cultural considerations, developmental issues (cognitive, emotional, physical), mental health/substance abuse assessment, career and retirement concerns, spirituality, and dying, death, and bereavement). Recommended theoretical approaches to counseling older adults, including attendant techniques and interventions are examined.

CSLG 6800. Individual Study in Counseling. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

CSLG 7110. Individual Assessment. (3) Examination of the major aptitude, intelligence. and other psychological tests commonly used in counseling with emphasis on test theory as well as the administration, scoring, and interpretation of tests and the communication of their results.

CSLG 7120. Administration and Supervision of Counseling Services. (3) Planning, operation, implementation and supervision of counseling and guidance services in schools and agencies with emphasis on the development of administrative and supervisory skills.

CSLG 7140. Consultation in School Counseling. (3) Introduction to the professional school counselor's role (K-12) in counseling, consulting, and coordinating school and community resources for the optimum benefit of the student.

CSLG 7141. The Professional School Counselor. (3) Cross-listed Course(s): CSLG 8141. An introduction to the profession of school counseling using the ASCA National Model as a basis for practice and program development. To support the school academic mission, students identify the necessary skills needed for the integration of various counseling activities that will include classroom guidance, individual and group counseling, consultation, program design, and coordinating school and community resources. Students also begin developing their professional School Counselor E-portfolio.

CSLG 7142. Introduction to Play Therapy. (3) Enhancing the counseling relationship with children by using play media to establish facilitative relationships with children under the age of ten years.

CSLG 7143. Child-Centered Relationship Training: An Approach for Parents/Caregivers/Teachers. (3) Prerequisite(s): CSLG 7142. An advanced-level play therapy course that focuses on concepts and skills of filial therapy for training parents/caregivers/teachers to be therapeutic agents in their children's lives through child centered play therapy skills in regularly scheduled structured play sessions with children.

CSLG 7144. Contemporary Theories of Play Therapy. (3) An advanced exploration of fundamental issues involved in play therapy, this seminar course focuses on an in-depth study of various theoretical approaches, modalities, techniques, and applications of play therapy. Historical and theoretical foundations of play therapy are presented as are current issues in providing appropriate counseling services to children aged three to ten years old.

CSLG 7145. Special Topics in Play Therapy. (3) Focuses on a variety of topics in play therapy such as conference, supervision of play therapy, and group play therapy. May be offered in alternative formats, such as weekend sessions and distance learning options.

CSLG 7146. Counseling Adolescents. (3) Cross-listed Course(s): CSLG 8146. Prerequisite(s): Graduate standing and permission of instructor. Focuses on counseling pre-adolescents and adolescents. Attention is given to the cognitive and socio-emotional development of pre-adolescents and adolescents, current issues affecting this population, ethical considerations when counseling this age group, and developmentally responsive counseling interventions.

CSLG 7147. Multicultural and Social Justice Issues in Play Therapy. (3) An advanced exploration of multicultural and social justice advocacy in play therapy. Focuses on self-awareness, knowledge, and skills relevant to providing culturally sensitive interventions to diverse children and their families. Topics include: racial and ethnic background, cultural heritage, family structure, religious and spiritual beliefs, disciplinary styles, adverse childhood experiences, and trauma informed interventions.

CSLG 7151. Approaches to Adult Career Development. (3) Prerequisite(s): CSLG 6150. For the career development specialist who needs to survey an environment in which adults are seeking career counseling; assess needs; develop interventions strategies to meet needs; and assess outcomes.

CSLG 7153. Research Techniques and Computer Applications in Career Counseling. (3) Prerequisite(s): RSCH 6101, RSCH 6109, and RSCH 6110. Skills in preparing a literature review upon which to base a research study; critiquing theoretical, philosophical, and research material and reports; and conducting and reporting a research study. Focus on understanding the effective application of computer technology to the provision of career-related services in mental health, education, rehabilitative or other human services settings.

CSLG 7160. Solution-Focused Brief Therapy. (3) Prerequisite(s): CSLG 6110, CSLG 6100, and CSLG 7430. An introduction to counseling in a time-limited manner while helping clients understand how they maintain their problems and how to construct solutions.

CSLG 7170. Introduction to Clinical Mental Health Counseling. (3) Counseling in community agency settings, including the roles and functions of a professional counselor, assessing the needs of an agency population and the interworkings of various agencies and agency networks.

CSLG 7190. Introduction to Pastoral Counseling. (3) Prerequisite(s): CSLG 6100 and CSLG 6110. Introduction to the field of pastoral counseling including both theological and counseling dimensions.

CSLG 7191. Advanced Issues in Pastoral Counseling. (3) Prerequisite(s): CSLG 7190. Specific content relevant to pastoral counseling including didactic and experiential foci.

CSLG 7205. Techniques of Family Counseling. (3) Prerequisite(s): CSLG 6100 and CSLG 6200. An overview of techniques used by family counselors working from communications, structural or strategic orientations.

CSLG 7430. Practicum in Counseling. (3) Prerequisite(s): CSLG 6100, CSLG 6101, CSLG 6110, and CSLG 7142 if working with children age 10 and younger. Supervision of individual and group counseling interventions conducted in field setting; special attention to the development of the counseling relationship of evaluative criteria for self and peer assessment. A minimum of 10 hours per week is required in field experience. *Graded on a Pass/Unsatisfactory basis.*

CSLG 7435. Internship in Counseling. (3) Prerequisite(s): CSLG 7430 and CSLG 7142 if working with children age 10 and younger. Students participate in delivering counseling services in a field setting and receive supervision of their work during weekly seminars. A minimum of 20 hours per week in field experience is required. *Graded on a Pass/Unsatisfactory basis.* This is a two semester internship and *May be repeated for credit.*

CSLG 7436. Advanced Internship in School Counseling. (3) Offered specifically for students enrolled in the Post-Master's Certificate Program in School Counseling. A minimum of 20 hours per week in field placement is required and students have the opportunity to demonstrate advanced level skills in weekly seminars. *Graded on a Pass/Unsatisfactory basis.*

CSLG 7600. Sexual Orientation Diversity in Clinical Practice. (3) Considers the experience of being gay, lesbian, bisexual, or transgendered in our society. Theoretical understandings of sexual orientation are covered, as well as the impact of societal prejudice on gay, lesbian, bisexual, and transgendered individuals and their communities. The experience of diversity with such communities is discussed, especially racial/ethnic diversity. Exploration of individual values combines with an emphasis on clinical practice to make this course relevant both personally and professionally.

CSLG 7601. Counseling and Spirituality. (3) Incorporates the spiritual dimension into the counseling process. It is specifically designed to help counselors understand their own spirituality and facilitate the inclusion of the spirituality

of others with whom they provide counseling services. Spirituality is viewed as an important component to the achievement of mental health and to a balanced sense of wellness. Basic beliefs and various models spiritual development are examined.

CSLG 7645. Cognitive-Behavior Theory and Practice. (3) An introduction to the theory and practice of cognitive-behavior therapy that can be applied in the school setting. Major theories (cognitive therapy, cognitive behavior modification, REBT, and reality therapy) are examined, and treatment planning and application of techniques are studied. (*Summer)*

CSLG 7646. Advocacy and Leadership in Professional School Counseling. (3) Cross-listed Course(s): CSLG 8646. Developing effective leadership skills for school counselors with an emphasis on organization, planning, management, and evaluation of comprehensive school counseling programs based on the ASCA National Model. Developing skills in the utilization of data for systemic change and student success are detailed in individual student advocacy projects. Requires the completion of their professional School Counselor E-portfolio.

CSLG 7680. Crisis Counseling. (3) Focuses on a general crisis intervention model and its application to specific crisis situations. Topics include: suicide intervention, rape crisis, telephone counseling, and disaster intervention.

CSLG 7681. Grief and Loss Counseling. (3) Examines the theory of loss, the tasks involved in grieving, and the skills needed by a counselor working with grief and loss issues. Loss will be examined from a broad perspective and includes issues associated with death, loss of relationships, and loss of abilities.

CSLG 7800. Individual Study in Counseling. (1 to 6) Prerequisite(s): Permission of advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

CSLG 8000. Topics in Counseling. (1 to 6) May include classroom and/or clinic experiences in the content area. *May be repeated for credit with permission of department.*

CSLG 8100. Advanced Theories of Counseling. (3) The principles and practices of traditional and more current theories are examined. Students explore philosophical and psychological assumptions of the counseling theories and engage in critical thinking as they examine the rationale and consequences of their pre-conceived notions about conditions that influence human behavior and change.

CSLG 8105. Introduction to Counselor Education and Supervision. (3) Required in the first semester of doctoral study. An orientation for doctoral students about the doctoral program, doctoral culture, the counseling faculty, and current and emerging professional issues in counselor education and supervision. Students become familiar with CACREP standards and how they apply to counselor education. In addition, students have the opportunity to learn about the research trends in the field of counseling. Finally, the course addresses professional development as a scholar.

CSLG 8106. Advanced Multicultural Career Counseling. (1) Prerequisite(s): CSLG 6150 or equivalent, and CSLG 8345. Designed to help advance student's level of knowledge by examining the most recent career development theory and research practices. Provides knowledge and require students to use higher level critical thinking skills needed to enhance the quality of the career development interventions delivered to diverse populations in our global economy. Students should have completed an introductory course in career development and counseling before enrolling in this course. *Graded on a Pass/Unsatisfactory basis.*

CSLG 8107. Advanced Group Seminar (1). Prerequisite(s): CSLG 6120 or equivalent, and CSLG 8431. Enhance understanding of group theory and practice. Integrates advanced group theory with application of group leadership skills. Students develop counseling skills by providing leadership to small laboratory counseling groups. Group leadership skills are linked to theoretical stages of group development. *Graded on a Pass/Unsatisfactory basis.*

CSLG 8110. Clinical Supervision in Counseling. (3) A critical overview of the conceptual and empirical literature on counseling supervision, including models, approaches/techniques, relationship and process issues, and ethical and legal considerations. Students will develop conceptual knowledge, skills, and self-awareness concerning these topic areas through readings, seminar discussions, and application via supervising master's level students.

CSLG 8111. Solution-Focused Brief Therapy. (3) Prerequisite(s): CSLG 6110, CSLG 6100, and CSLG 7430. An introduction to counseling in a time-limited manner while helping clients understand how they maintain their problems and how to construct solutions.

CSLG 8141. The Professional School Counselor. (3) Cross-listed Course(s): CSLG 7141. An introduction to the profession of school counseling using the ASCA National Model as a basis for practice and program development. To support the school academic mission, students identify the necessary skills needed for the integration of various counseling activities that will include classroom guidance, individual and group counseling, consultation, program

design, and coordinating school and community resources. Students also begin developing their professional School Counselor E-portfolio.

CSLG 8146. Counseling Adolescents. (3) Cross-listed Course(s): CSLG 7146. Prerequisite(s): Graduate standing and permission of instructor. Focuses on counseling pre-adolescents and adolescents. Attention is given to the cognitive and socio-emotional development of pre-adolescents and adolescents, current issues affecting this population, ethical considerations when counseling this age group, and developmentally responsive counseling interventions.

CSLG 8153. Diagnosis and Treatment in Counseling. (3) Cross-listed Course(s): CSLG 6153. Prerequisite(s): Graduate standing in Ph.D. in Counselor Education and Supervision program. Developing diagnostic skills using the *Diagnostic and Statistical Manual of Mental Disorders (DSM-V)* multi-axial classification system for mental and emotional disorders. Provides an overview of theory, research, and practice related to diagnosis and treatment. Diagnostic criteria is studied with a sensitivity to cultural and ethnic issues.

CSLG 8160. Theories of Addiction. (3) Introduction to the theoretical, philosophical, and historical premises upon which addiction is explained and treatment and prevention are based. Biological, psychological, and sociological etiologies of substance use and related addictive disorders are studied.

CSLG 8161. Assessment and Diagnosis of Addictive Disorders. (3) Process and procedures for professional biopsychosocial assessment and diagnosis of substance use and related addictive disorders in adolescents and adults. Implications of addiction for clients and their families are addressed.

CSLG 8162. Interventions in Addiction Counseling. (3) A counseling techniques course designed to help students who have worked as professional addiction counselors and those who have little or no experience working with addicted individuals and their families.

CSLG 8163. Treatment Planning and Relapse Prevention in Addiction Counseling. (3) An introduction to the principles and practices upon which addiction treatment and relapse prevention are based. Students gain practical experience in assessment, diagnosis, treatment planning, and relapse prevention planning with addicted clients.

CSLG 8164. The McLeod Institute on Addiction. (3) Cross-listed Course(s): CSLG 8164. A hybrid course delivered through a combination of independent learning, self-directed study, attending the McLeod Institute on Addiction conference, and completing all required course assignments by end of Summer Session I. The McLeod Institute on Addiction is a conference offered annually during the third week in May. The topics vary yearly and are designed to provide both broad and specific knowledge germane to addiction counseling. *May be repeated for credit.*

CSLG 8200. Introduction to Theories of Family Counseling. (3) Examination of appropriate interventions in working with families focusing on major theorists and techniques in the field.

CSLG 8201. Counseling Needs of Women. (3) Women's development and needs, the problems they bring to counselors, strategies for helping with them, myths about women and biases in psychological research.

CSLG 8202. Counseling Military Families and Children. (3) Cross-listed Course(s): CSLG 6202. Provides the opportunity to learn about the unique culture of military families and children. Specific challenges and stressors they encounter while serving in the U.S. Armed Forces are thoroughly addressed. Some of the topics explored include: characteristics of active duty personnel; National Guard and Reserve members; military children; stages of deployment; and various social, emotional, physical, and mental health concerns. Students completing this course also learn about evidence-based approaches and interventions, and develop a more in-depth understanding of how to work effectively with this specific population.

CSLG 8203. Instructional Theory in Counselor Education. (3) Prepares students to become professors in counselor education. An examination of the theories and methods of teaching in higher education will be explored. Readings from professional journals, lecture, discussion, and practical application in the classroom are used to meet course objectives.

CSLG 8204. Counseling Military Veterans. (3) Cross-listed Course(s): CSLG 6204. A comprehensive overview of issues impacting military veterans. Specific cultural factors such as race, gender, and sexual orientation are also taken into consideration. Topics include: career transitions, family matters, mental health stigma, traumatic brain injury, suicide, PTSD, depression, homelessness, and addiction. Resilience and strength of military veterans is also addressed. In addition, students learn about evidence-based techniques, strategies, and approaches utilized to work effectively with military veterans.

CSLG 8345. Advanced Multicultural Counseling. (3) An advanced exploration of fundamental issues involved in culturally competent counseling, this seminar course focuses on an in-depth study of various cultures seeking counseling services. Students examine various oppression

models and have an opportunity to apply them to cultures in our community.

CSLG 8346. Applied Multicultural Counseling. (3) The impact of oppression on the daily lives of marginalized groups. Students conduct extensive field-based investigations into various cultures in order to gain mastery-level knowledge of the practical day-to-day experiences especially as they involve accessing mental health services. Special focus on counseling applications that are appropriate within and between cultures. Learning to utilize systems interventions and the mastering the skills of consultation are key components of this course.

CSLG 8442. Doctoral Internship: Supervision. (3) Provides students with the practical experiences necessary to provide individual supervision of counselors, including field supervision and analyses of counseling audio and videotapes. Students have the opportunity to test their conceptual knowledge, skill, and self-awareness developed through prerequisite coursework. Students receive weekly individual/triadic supervision and regular weekly group supervision. A minimum of 200 clock hours is required. *Graded on a Pass/Unsatisfactory basis.*

CSLG 8431. Doctoral Practicum in Counseling. (3) Practicum is an applied course where students develop and/or refine their counseling skills. These skills will be conceptually linked counselor education and supervision. Working in sites throughout the community, students produce audio and/or video tapes of individual and group counseling practice for supervision. *Graded on a Pass/Unsatisfactory basis.*

CSLG 8440. Doctoral Internship: Counseling. (3) Prerequisite(s): CSLG 8100 and CSLG 8431. Students deliver counseling in a field setting and receive individual/triadic supervision and regular weekly group supervision. A minimum of 200 clock hours is required. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit with permission of department.*

CSLG 8443. Doctoral Internship: Research. (1 to 3) Prerequisite(s): CSLG 8105. Assists students in conducting an empirical study in the counseling field and to report their research findings in a journal article. Students take this course beginning in their second semester of doctoral studies, for 3 consecutive semesters (Spring, Fall, Spring, etc.). They enroll for 1 credit hour each semester and accumulate a total of 3 credit hours over this 3 semester sequence. A minimum of 200 clock hours is required over the 3 semesters. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

CSLG 8445. Doctoral Internship: Teaching. (3) Students deliver teaching in counselor education in a field setting and receive weekly individual/triadic supervision and regular weekly group supervision. A minimum of 200 clock hours is required. *Graded on a Pass/Unsatisfactory basis.*

CSLG 8600. Sexual Orientation Diversity in Clinical Practice. (3) Considers the experience of being gay, lesbian, bisexual, or transgendered in our society. Theoretical understandings of sexual orientation are covered, as well as the impact of societal prejudice on gay, lesbian, bisexual and transgendered individuals and their communities. The experience of diversity with such communities is discussed, especially racial/ethnic diversity. Exploration of individual values combines with an emphasis on clinical practice to make this course relevant both personally and professionally.

CSLG 8601. Counseling and Spirituality. (3) Incorporates the spiritual dimension into the counseling process. It is specifically designed to help counselors understand their own spirituality and facilitate the inclusion of the spirituality of others with whom they provide counseling services. Spirituality is viewed as an important component to the achievement of mental health and to a balanced sense of wellness. Basic beliefs and various models spiritual development are examined.

CSLG 8604. Counseling Sexual Minority Families and Couples. (3) Focuses on the unique challenges facing the counselor who is providing clinical services to gay, lesbian, bisexual and transgendered families and couples. Topics include: the impact of oppression on primary relationships, the political implications of sexual minority relationships, relationship models, parenting, and interacting with the outside world.

CSLG 8645. Cognitive-Behavior Theory and Practice. (3) An introduction to the theory and practice of cognitive-behavior therapy that can be applied in the school setting. The major theories (cognitive therapy, cognitive behavior modification, REBT, and reality therapy) are examined, and treatment planning and application of techniques are studied.

CSLG 8646. Advocacy and Leadership in Professional School Counseling. (3) Cross-listed Course(s): CSLG 7646. Developing effective leadership skills for school counselors with an emphasis on organization, planning, management, and evaluation of comprehensive school counseling programs based on the ASCA National Model. Developing skills in the utilization of data for systemic change and student success are detailed in individual student advocacy projects. Requires the completion of their professional School Counselor E-portfolio.

CSLG 8680. Crisis Counseling. (3) Focuses on a general crisis intervention model and its application to specific crisis

situations. Topics include: suicide intervention, rape crisis, telephone counseling, and disaster intervention.

CSLG 8681. Grief and Loss Counseling. (3) Examines the theory of loss, the tasks involved in grieving, and the skills needed by a counselor working with grief and loss issues. Loss will be examined from a broad perspective and includes issues associated with death, loss of relationships, and loss of abilities.

CSLG 8800. Individual Study in Counseling. (1 to 6) Prerequisite(s): permission of student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit. Graded on a Pass/Unsatisfactory basis.*

CSLG 8998. Seminar in Prospectus Design. (3) Provide students the opportunity to identify and define a research area of inquiry and develop a proposal draft for the dissertation study. Students will be expected to select, plan and outline an original research study appropriate for the dissertation requirement.

CSLG 8999. Dissertation. (1 to 9) Under the direction of a dissertation advisor and committee, students are expected to design and execute an original research study. This study should address a significant issue or problem related to counseling or counselor education. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Curriculum and Supervision (CUSU)

CUSU 6000. Topics in Curriculum and Supervision. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with change of topic and permission of department.*

CUSU 6100. Fundamentals of Educational Leadership. (3) The developing role of educational organizations in the United States and the societal and cultural influences that affect the delivery of schooling. Structure and organization of American schools, administrative and organizational theory, legal, moral, and ethical dimensions of schooling within the context of restructuring and reform.

CUSU 6105. Legal Aspects of Schooling. (3) Education law for education professionals which focuses on the legal rights and responsibilities of students, teachers, and administrators and how these legal provisions affect educational policy and practice.

CUSU 6122. Foundations of Curriculum Theory and Development. (3) Foundations of historical curriculum development, philosophic beliefs, and understanding of the development of the American public school system.

CUSU 6123. Designs in Curriculum Practices. (3) Examines the field of curriculum with particular emphasis on the classroom application of different models of teaching and the change process.

CUSU 6130. Supervision of Instruction. (3) Introduction to clinical supervision and development of skills in classroom observation, analysis, evaluation, and assistance. Systems of observation, principles of adult development in school settings, techniques for conducting classroom observations and conferences, and development of staff development programs to remedy assessed weaknesses.

CUSU 6491. Internship in Curriculum and Supervision. (6) Prerequisite(s): Permission of the department. Internship under the supervision of University and on-site personnel in a setting consistent with the student's professional goals in which the student will be involved in the diverse activities expected of the professional administrator.

CUSU 6601. Seminar in Curriculum and Supervision. (3) Capstone class in curricular and supervisory leadership. Exploration of seminal topics and preparation for the internship.

CUSU 6800. Independent Study in Curriculum and Supervision. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

CUSU 8000. Topics in Curriculum and Supervision. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with change of topic and permission of department.*

CUSU 8126. National and International Developments in the Community College. (3) Prerequisite(s): Admission to the doctoral program in Educational Leadership or Curriculum and Instruction and advisor approval. Doctoral seminar study that compares international issues and developments in the community college in other countries with those of the United States. Topics include: historical development of junior/community college, the role of the community college in different cultures, types of programs offered, and trends for the future. There will also be opportunity for students to pursue individual areas of interest.

CUSU 8127. Comparative Higher Education. (3) Prerequisite(s): Admission to the doctoral program in Educational Leadership or Curriculum and Instruction and advisor approval. Doctoral seminar study that compares international issues and developments in higher education

in other countries with those in the United States. Topics include: historical development of the university, purpose of the university in different cultures, current expectations for faculty and students, and trends for the future. There will also be opportunity for students to pursue individual areas of interest.

CUSU 8800. Independent Study in Curriculum and Supervision. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

CUSU 8999. Dissertation Research. (3) Prerequisite(s): Permission of the Ed.D. program coordinator. Execution of original research study that addresses the solution to an educational or school-related problem or that addresses a substantive curricular or supervisory leadership or programmatic issue.

Data Science and Business Analytics (DSBA)

DSBA 5110. Applied Regression Analysis. (3) Cross-listed Course(s): STAT 5110. Prerequisite(s): MATH 2164; and STAT 2122, STAT 3128, or equivalent; or permission of department. Theoretical and practical training in statistical modeling with particular emphasis on the application of linear regression and multivariate statistical analysis. The basic fundamentals and statistical inference techniques associated with regression models are introduced. Students also learn how to apply the statistical techniques to extract information from data generated in various application areas using statistical software. Topics include: linear regression, model adequacy checking and diagnostics, generalized linear regression, and multivariate statistical analysis.

DSBA 5121. Information Visualization. (3) Cross-listed Course(s): ITCS 5121 and HCIP 5121. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. Information visualization concepts, theories, design principles, popular techniques, evaluation methods, and information visualization applications.

DSBA 5122. Visual Analytics and Storytelling. (3) Cross-listed Course(s): HCIP 5122. Prerequisite(s): Full graduate standing, enrollment in the DSBA PSM or Graduate Certificate program, and approval of the Program Director. The data science cycle includes many phases, including problem definition, data acquisition, data engineering, analysis, reporting, interpreting, visualization, and presentation of the results of analysis/insights derived. This course covers the last three steps in this sequence. It introduces the field of visual analytics, which integrates interactive analytical methods and visualization, and utilizes this to build analytical stories that influence decision makers. Topics include: critical thinking, visual reasoning, perception/cognition, principles of interaction with an audience, building of visuals into a story to influence, and delivery of presentations whether in person or through video conferencing tools.

DSBA 5510. Web Mining. (3) Cross-listed Course(s): ITIS 5510. Pre- or Corequisite(s): DSBA 6160, full graduate standing, and enrollment in the DSBA PSM or Graduate Certificate program. Topics include: measuring and modeling the Web; crawling, Web search and information retrieval; unsupervised learning, supervised learning, semi-supervised learning in Web context; social network analysis and hyperlink analysis; text parsing and knowledge representation.

DSBA 6010. Special Topics in Data Science and Business Analytics. (3) Prerequisite(s): Enrollment in the M.S. or Graduate Certificate in Data Science and Business Analytics program. Specialized and contemporary topics of interest for students in the Data Science and Business Analytics program. Topics are chosen and covered to respond to the changes in the data science and analytics areas and to emerging needs of data science and analytics skills from employers.

DSBA 6100. Big Data Analytics for Competitive Advantage. (3) Cross-listed Course(s): HCIP 6103 and ITCS 6100. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. An introduction to the use of big data as a strategic resource. A focus is placed on integrating the knowledge of analytics tools with an understanding of how companies leverage data analytics to gain strategic advantage. A case approach is used to emphasize hands-on learning and a real-world view of big data analytics.

DSBA 6112. Graduate Econometrics. (3) Cross-listed Course(s): ECON 6112. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. Advanced study of the theory and application of statistics to economic problems. Topics include: derivation of least-squares estimators; maximum likelihood estimation; and problems of multicollinearity, heteroskedasticity, and autocorrelation.

DSBA 6115. Statistical Learning with Big Data. (3) Cross-listed Course(s): STAT 6115. A survey of major statistical learning concepts and methods for big data analysis, including both supervised and unsupervised learning such as resampling methods, support vector machines, model selection and regularization, tree-based methods and ensembles, and statistical graphics. Students learn how and when to apply statistical learning techniques, their

comparative strengths and weaknesses, and how to critically evaluate the performance of learning algorithms in case studies in financial investment, gene identification, and feature selection in high-dimensional spaces.

DSBA 6122. Decision Modeling and Analysis. (3) Cross-listed Course(s): MBAD 6122. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. An analytical approach to the management process. Generalized models for decision making with major emphasis on application of the scientific method to management problems.

DSBA 6155. Knowledge-Based Systems. (3) Cross-listed Course(s): ITCS 6155. Prerequisite(s): ITCS 6162, full graduate standing, and enrollment in the DSBA PSM or Graduate Certificate program. Knowledge systems; knowledge discovery; association rules; action rules, hierarchical classifiers, cascade classifiers, query languages and their semantics; cooperative and collaborative systems; ontology and metadata; flexible query answering; chase algorithms and data sanitization methods; decision support systems in medicine; and automatic indexing of music.

DSBA 6156. Applied Machine Learning. (3) Cross-listed Course(s): HCIP 6156. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. Practical perspectives and applications of machine learning methods and techniques including: acquisition of declarative knowledge; organization of knowledge into new, more effective representations; development of new skills through instruction and practice; and discovery of new facts and theories through observation and experimentation.

DSBA 6160. Database Systems for Data Scientists. (3) Cross-listed Course(s): HCIP 6160. Prerequisite(s): Full graduate standing and enrollment in M.S. or Graduate Certificate in Data Science program.. The modeling, programming, integration, and provenance of big data. Focuses on SQL and NoSQL, but may also address other advanced topics. Topics include: (1) modeling/theory: basics of RDBMS and NoSQL, database design; (2) programming: SQL and NoSQL query languages; (3) integration: data warehousing, preprocessing; (4) databases in the Cloud; and (5) provenance: data version control, data lifecycle management.

DSBA 6162. Knowledge Discovery in Databases. (3) Cross-listed Course(s): HCIP 6162, ITCS 6162, and ITIS 6162. Prerequisite(s): DSBA 6160, full graduate standing, and enrollment in the DSBA PSM program. The entire knowledge discovery process is covered. Topics include: setting up a problem, data preprocessing and warehousing, data mining in search for knowledge, knowledge evaluation, visualization and application in decision making. A broad range of systems, such as OLAP, LERS, DatalogicR+, C4.5, AQ15, Forty-Niner, CN2, QRAS, and discretization algorithms are discussed.

DSBA 6165. Artificial Intelligence and Deep Learning. (3) Prerequisite(s): DSBA 6156. Introduces state-of-the-art methods in deep learning while setting a proper context for the growth of machine learning by providing an overview of the broader field of artificial intelligence (AI). Topics emphasize neural networks and deep learning architectures, but also include broader AI concepts such as knowledge representation, computer vision, as well as advanced learning methods such as transfer learning and reinforcement learning. Application of the deep learning methods to real world problems such as computer vision, natural language processing, and genomic analysis are examined both in class and in projects.

DSBA 6170. Ethics, Privacy, Security and Governance of Big Data. (3) Provides data science graduate students with an overview of the challenges, theories, and solutions related to the ethics, security, privacy, and governance of big data. First examined are the most substantial ethical concerns that arise with big data, with attention to the ways that policies and technological developments can either ameliorate or increase them. Then contemporary methods and technologies are surveyed, as well as governance laws and policies that have been proposed or already deployed in the industry to ensure secure and proper handling of big data and analytical results. The course is team-taught by both experts in legal and ethical matters and experts in security and privacy technologies.

DSBA 6188. Text Mining and Information Retrieval. (3) Introduces the general computational techniques for analyzing large amounts of text data, as well as basic techniques for information retrieval. By introducing text mining (TM) and information retrieval (IR) in a unified framework, this course emphasizes the importance of integration of IR and TM needed to build the two major types of text information systems, i.e., search engines (such as Google, MS Bing, etc.) and text analytics systems, for text information access and text analysis.

DSBA 6190. Cloud Computing for Data Analysis. (3) Cross-listed Course(s): ITCS 6190 and ITCS 8190. Prerequisite(s): ITCS 6114 or permission of department; familiarity with Java, Unix, Data Structures and Algorithms, Linear Algebra, and Probability and Statistics; good programming skills; and a solid mathematical background. Introduction to the basic principles of cloud computing for data-intensive applications. Focuses on parallel computing using Google's MapReduce paradigm on Linux clusters, and algorithms for large-scale data analysis applications in web search, information retrieval, computational advertising, and business and scientific data analysis. Students read and present research papers on these

topics, and implement programming projects using Hadoop, an open source implementation of Google's MapReduce technology, and related NoSQL technologies for analyzing unstructured data.

DSBA 6201. Business Intelligence and Analytics. (3) Prerequisite(s): Full graduate standing, and enrollment in the DSBA PSM or Graduate Certificate program. An overview of the business approach to identifying, modeling, retrieving, sharing, and evaluating an enterprise's data and knowledge assets. Focuses on the understanding of data and knowledge management, data warehousing, data mining (including rule-based systems, decision trees, neural networks, etc.), and other business intelligence concepts. Covers the organizational, technological and management perspectives.

DSBA 6207. Business Project Management. (3) Cross-listed Course(s): MBAD 6207. Prerequisite(s): MBAD 5121 or equivalent; MBAD 6141; full graduate standing; and enrollment in the DSBA PSM or Graduate Certificate program. Project management is widely used in a variety of business environments to manage complex, non-routine endeavors. Examples of projects include consulting and process improvement projects, advertising projects, and technology projects. Focuses on tools, techniques, and skills for business project management, with attention to both the quantitative and the qualitative aspects of project management. Topics include: project evaluation, estimation, monitoring, risk management, audit, managing global projects, outsourcing, and project portfolio management. Students also gain experience using Project Management Software.

DSBA 6208. Supply Chain Management. (3) Cross-listed Course(s): MBAD 6208. Prerequisite(s): MBAD 6141, full graduate standing, and enrollment in the DSBA PSM or Graduate Certificate program. Supply chain management is concerned with all of the activities performed from the initial raw materials to the ultimate consumption of the finished product. From a broad perspective, the course is designed to examine the major aspects of the supply chain: the product flows; the information flows; and the relationships among supply chain participants. The course content is interdisciplinary in nature and covers a variety of topics such as supply chain information technologies, supply chain design, strategic alliances between supply chain participants and supply chain initiatives.

DSBA 6211. Advanced Business Analytics. (3) Cross-listed Course(s): MBAD 6211. Prerequisite(s): DSBA 6162 or DSBA 6201; full graduate standing; and enrollment in the DSBA PSM or Graduate Certificate program. An in-depth study of applications of data analytics techniques to discover non-trivial relationships that are understandable, useful, and actionable to decision makers. A case approach is used to emphasize hands-on learning and real-world deployment of business analytics.

DSBA 6212. Enterprise Systems. (3) Cross-listed Course(s): MBAD 6212. Prerequisite(s): Permission of DSBA Program Director. An overview of Enterprise Resource Planning (ERP). Using business cases and hands-on training with ERP tools, students learn how ERP systems support an organization's core business processes in achieving its strategic and operational goals. The role of ERP systems in business analytics and intelligence, the configuration of ERP systems, and the methods of evaluation, selection and implementation of ERP systems are also covered.

DSBA 6213. Applied Healthcare Business Analytics. (3) Cross-listed Course(s): HCIP 6213 and MBAD 6213. Prerequisite(s): Demonstrated proficiency with Microsoft Excel; and HCIP 5123, STAT 5123, HADM 6108 (for students with background in healthcare administration), HCIP 6108 (for students with background in healthcare informatics), or equivalent. Focuses on applying business analytics within the healthcare setting. Students learn analytical tools used to synthesize big data into meaningful management information that is used in making key business decisions that impact the delivery of healthcare services. Case studies are utilized to prepare students for delivering boardroom level presentations of their findings.

DSBA 6265. Advanced Topics in Knowledge Discovery in Databases. (3) Cross-listed Course(s): ITCS 6265. Prerequisite(s): DSBA 6162 or permission of instructor; full graduate standing; and enrollment in the DSBA PSM program. Information visualization in data mining and knowledge discovery, predictive data mining, mining of multimedia sources, mining of unstructured data, distributed data mining, mining of Web data/information, mining complex types of data, mining of biotechnology data, applications, and trends in data mining.

DSBA 6276. Strategic Business Analytics. (3) Cross-listed Course(s): MBAD 6276. Develops and utilizes quantitative decision models to establish and implement marketing strategies. Ever-changing marketplaces are making an impact on the way business practitioners conduct their everyday operations. Given the business environment, using both quantitative and qualitative business data, students develop insights into practical business problems in various decision contexts ranging from consumer segmentation to market response models to new product development.

DSBA 6277. Social Media Marketing and Analytics. (3) Cross-listed Course(s): MBAD 6277. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. The utilization of social media in marketing strategy and tactics. Topics include: the use of social media in building brand strength and

equity, as a customer acquisition tool, and as a customer relationship management tool. The utilization of analytics in effective social media marketing.

DSBA 6278. Innovation Analytics. (3) Cross-listed Course(s): MBAD 6278. Prerequisite(s): Full graduate standing; and enrollment in the DSBA PSM or Graduate Certificate program. The comprehension and application of text analytics as a tool to examine unstructured qualitative information to generate innovations. Identifying the various sources of consumer insight and using them in innovation strategy. Understand how to differentiate between what consumers want versus what they say.

DSBA 6284. Digital Marketing Analytics. (3) Explores important techniques in marketing analytics with a focus on digital marketing applications. The primary purpose is to expose students with the essential data-analysis knowledge, methodologies, and hands-on experiences of analytical tools combined with lectures, discussions, and interactive communications to help students develop pragmatic problem-solving skills and learn to apply different tools in different decision-making settings. The course is structured on analyzing data through case studies and business applications either as homework/assignments or in-class hands-on exercises.

DSBA 6345. Modern Data Science Systems. (3) Cross-listed Course(s): ITCS 6345. Prerequisite(s): DSBA 6156. Advanced and recent techniques in data science, and their applications to business problems. Topics include: enterprise search and question answering, machine learning with neural networks, probabilistic and graph algorithms, and topological data analysis. Most assignments are done "in the cloud." The course assumes basic knowledge of data science exemplified by a graduate, undergraduate, or online machine learning course; a natural language processing course; as well as knowledge of elementary linear algebra, calculus, and statistics. Some experience with cloud computing is also expected.

DSBA 6400. Internship. (3) Prerequisite(s): Completion of 21 credit hours of core course requirements. A data science or business analytics project is chosen and completed under the guidance of an industry partner. Each student's internship project program must be approved by the program director. A proposal form must be completed and approved prior to registration and the commencement of the internship. A mid-term report and a final report to be evaluated by the industry partner and supervising faculty. Grading is by the supervising faculty in consultation with off-campus supervisor at the internship organization. *Graded on a Pass/Unsatisfactory basis.*

DSBA 6500. Complex Adaptive Systems. (3) Cross-listed Course(s): HCIP 6500, ITCS 6500, ITCS 8500, ITIS 6500 and ITIS 8500. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Covers those and similar topics in an interactive manner. Examples of our current research effort are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity.

DSBA 6520. Network Science. (3) Cross-listed Course(s): HCIP 6520, ITIS 6520, and ITIS 8520. Prerequisite(s): Full graduate standing and enrollment in the DSBA PSM or Graduate Certificate program. Network Science helps students design faster, more resilient communication networks; revise infrastructure systems such as electrical power grids, telecommunications networks, and airline routes; model market dynamics; understand synchronization in biological systems; and analyze social interactions among people. It examines the various kinds of networks (regular, random, small-world, influence, scale-free, and social) and applies network processes and behaviors to emergence, epidemics, synchrony, and risk. This course integrates concepts across computer science, biology, physics, social network analysis, economics, and marketing.

Electrical and Computer Engineering (ECGR)

ECGR 5090. Special Topics. (1 to 6) Directed study of current topics of special interest. *May be repeated for credit.*

ECGR 5100. Research Tools and Techniques in Computer Engineering. (3) Cross-listed Course(s): ECGR 4100. Prerequisite(s): Graduate standing. Introduces students to the fundamentals of computer engineering research and the practical tools required collect, analyze, and report research results. Key engineering mathematics topics are covered such as the propositional and predicate calculus, analysis of algorithms, and graph theory. Students are

exposed to compiling software packages and device drivers as well as the conventions for developing similar software. Credit for ECGR 5100 will not be given where credit has been given for ECGR 4100.

ECGR 5101. Advanced Embedded Systems. (3) Cross-listed Course(s): ECGR 4101. Prerequisite(s): Graduate standing. An advanced course in embedded system design utilizing advanced microprocessors. Architecture, software, and interface techniques. This course is project-oriented, involving the use of a logic analyzer and hardware design tools. Credit will not be given for ECGR 5101 where credit has been given for ECGR 4101.

ECGR 5102. Engineering Simulation. (3) Prerequisite(s): ECGR 2103 or equivalent. A wide range of simulation related topics will be introduced including the theory of simulation, characteristics of simulators, and trade-offs in simulation studies. Continuous and discrete simulation with primary emphasis on application of simulation techniques to engineering problems. Simulation of actual problems based on students' interest and experience areas. Credit will not be given for ECGR 5102 where credit has been given for ECGR 4102.

ECGR 5103. Applied Computer Graphics. (3) Prerequisite(s): ECGR 3111 or permission of the department. Interactive graphics; raster, character, vector, graphics, display technologies; rotation, scaling, translating of graphics image; image processing/enhancement; feature extraction; 3-D graphics. Credit will not be given for ECGR 5103 where credit has been given for ECGR 4103.

ECGR 5104. Computational Methods in Power Systems. (3) Prerequisite(s): ECGR 4142 or equivalent. Numerical techniques for analysis, operation and planning of power systems. Sparse matrix techniques applied to power flow algorithms. Economic operation of power systems. Optimum power flow. Credit will not be given for ECGR 5104 where credit has been given for ECGR 4104.

ECGR 5105. Introduction to Machine Learning. (3) Cross-listed Course(s): ECGR 4105. Machine learning is a sub-field of Artificial Intelligence that gives computers the ability to learn and/or act without being explicitly programmed. This course covers the necessary theory, principles, and algorithms for machine learning. Topics include: supervised, unsupervised learning approaches (including deep learning), optimization procedures, and statistical inference. Students digest and practice their knowledge and skills by class discussion, homework, and exams, as well as obtain in-depth experience with a particular topic through a final project.

ECGR 5106. Real-Time Machine Learning. (3) Cross-listed Course(s): ECGR 4106. Prerequisite(s): A background in programming is required. An interactive practical introduction to real-time machine learning and deep learning inference based on leveraging Nvidia Jetson platform. Introduces Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) inference algorithms for real-time computer vision and scene analysis, including object detection, pose estimation, and activity analysis. Examines basic deep learning constructs based on current design tools (e.g., Pytorch and Real-time Tensorflow libraries).

ECGR 5111. Control Systems. (3) Prerequisite(s): permission of instructor. Mathematical models and characteristics of control systems. Performance and stability of linear feedback systems. Root locus and frequency response techniques. Stability in frequency domain. Time domain analysis. Design and compensation of control systems. Credit will not be given for ECGR 5111 where credit has been given for ECGR 4111.

ECGR 5112. Nonlinear Analysis. (3) Prerequisite(s): ECGR 3111 or equivalent. Solution of nonlinear problems using numerical and graphical methods, phase plane plots, analysis of singular points and analytical techniques. Forced oscillating systems. Stability of nonlinear systems. Use of analog and digital computer to study nonlinear problems.

ECGR 5113. Network Synthesis. (3) Prerequisite(s): ECGR 4113 or equivalent. The positive real concept, properties and methods of testing. Realizability conditions on driving point functions. Methods of synthesis of one-port. Physical realizability and properties of two-port networks. Transfer function synthesis. Approximation methods. Credit will not be given for ECGR 5113 where credit has been given for ECGR 4183.

ECGR 5114. Device Characterization, Parameterization and Modeling. (3) Prerequisite(s): ECGR 3132 and ECGR 4134 or their equivalents. Advance device and circuit analysis; device and circuit simulation using SPICE, ECAP or equivalent. Parametric modeling of active devices. Device characterization and parameterization; temperature effects; thermal cycling. Analysis of device failure modes. Credit will not be given for ECGR 5114 where credit has been given for ECGR 4184.

ECGR 5121. Antennas. (3) Prerequisite(s): ECGR 3122 or equivalent. Radiation into free space, the point source, thin linear antenna, arrays of linear elements, aperture antennas, impedance, methods of feeding, matching and termination. Antenna systems. Credit will not be given for ECGR 5121 where credit has been given for ECGR 4121.

ECGR 5122. Random Processes and Optimum Filtering. (3) Cross-listed as ECGR 5122. Prerequisite(s): ECGR 3111 and STAT 3128 or permission of department. Review of probability, univariate and multivariate distribution

functions; random processes, discrete and continuous time processes, widesense stationary, ergodicity; time- and frequency-domain analysis; linear systems, optimum filtering, Wiener filters, Kalman filters; application. Credit will not be given for ECGR 5122 where credit has been given for ECGR 4422.

ECGR 5123. Advanced Electromagnetic Field Theory. (3) Prerequisite(s): ECGR 3122 or equivalent. Maxwell's equations and propagation. Properties of guided and surface waves. Wave properties of light; physical and fiber optics. Credit will not be given for ECGR 5123 where credit has been given for ECGR 4185.

ECGR 5124. Digital Signal Processing. (3) Prerequisite(s): ECGR 3111 or equivalent. Sampling and signal recovery in linear systems; analysis of sampled systems; discrete and fast Fourier transforms; z-transform; discrete convolution; design of digital FIR and IIR filters. Credit will not be given for ECGR 5124 where credit has been given for ECGR 4124.

ECGR 5125. Foundation of Optical Engineering. (3) Prerequisite(s): ECGR 3121 and PHYS 3141, with a grade of C or above or permission of the department. The engineering aspects and applications of modern optics, optical communications, optical materials, optical devices, basic optical fiber and integrated optics, optical signals, and optical modulation, multiplexing, and related networks, basic Fourier optics and its application in optical images and information. Credit will not be given for ECGR 5125 where credit has been given for ECGR 4125.

ECGR 5127. Machine Learning for the Internet of Things. (3) Cross-listed Course(s): ECGR 4127. Prerequisite(s): ECGR 4105 or ECGR 5105. The concepts and skills necessary to design, train, and deploy machine learning models in resource-constrained devices are explored. Topics include: analysis of the computational requirements of machine learning models; requirements of edge-deployed machine learning; techniques to reduce storage, computation, and latency; and software tools available. The concepts are applied through a series of projects.

ECGR 5132. Analog Integrated Circuit Design. (3) Prerequisite(s): ECGR 4131 or equivalent. Topics include: analog MOS modeling, design of current mirrors, references, and operational amplifiers. Both hand analysis and SPICE simulation utilized. Credit will not be given for ECGR 5132 where credit has been given for ECGR 4132.

ECGR 5133. VLSI Systems Design. (3) Prerequisite(s): ECGR 2181 and 3131 or their equivalents. Analysis, design, and synthesis of very large scale integrated circuits. A project-oriented course relying heavily on computer-aided design tools for logic, layout design, and simulation. Credit will not be given for ECGR 5133 where credit has been given for ECGR 4433.

ECGR 5134. Advanced VLSI Systems Design. (3) Prerequisite(s): ECGR 5133 or permission of department. A project-oriented course dealing with advanced topics in VLSI systems design and analysis such as circuit design techniques, array structures, performance estimation, automated routing and device electronics. Credit will not be given for ECGR 5134 where credit has been given for ECGR 4188.

ECGR 5135. Physical Electronics. (3) Prerequisite(s): ECGR 3122 or equivalent. Dynamics of charged particles; electron motion in electromagnetic fields; types of electron emission; beam focusing; longitudinal and transverse beam waves; microwave generation; plasma parameters. Credit will not be given for ECGR 5135 where credit has been given for ECGR 4135.

ECGR 5136. Semiconductor Optoelectronic Materials and Devices. (3) Prerequisite(s): ECGR 3133 with grade of C or above, or permission of department. Direct and indirect bandgap materials; Compound and wide bandgap semiconductors; Electronic properties; Optical properties; Generation and recombination; Junction theory; Light emitting devices; Optical detectors. Credit will not be given for ECGR 5136 where credit has been given for ECGR 4136.

ECGR 5137. Device Electronics for Integrated Circuits. (3) Prerequisite(s): ECGR 3132 and ECGR 4134 or their equivalents. The basic operating principles of electronic devices in integrated circuits are treated. The physical models of these devices are discussed. Graduate students are required to carry out laboratory experimentation. Credit will not be given for ECGR 5137 where credit has been given for ECGR 4137.

ECGR 5138. Electronic Thin Film Materials and Devices. (3) Prerequisite(s): ECGR 4133 or 3132, or equivalent. Applications of thin films in microelectronics / optoelectronics manufacturing processes; vacuum technology, deposition techniques, and the characterization methods relevant to optoelectronic applications; thin film applications such as metallization, silicide formation, light emitting diodes (LED) and lasers, and doping of semiconductors. Credit will not be given for ECGR 5138 where credit has been given for ECGR 4138.

ECGR 5139. Digital Communication Systems. (3) Prerequisite(s): ECGR 3111 or equivalent. Topics include: digital data transmission systems, signal and system representation, digital system performance characterization, pulse code modulation, and statistical communications theory. Credit will not be given for ECGR 5139 where credit has been given for ECGR 4139.

ECGR 5140. Introduction to VLSI Processing. (3) Prerequisite(s): permission of department. Microelectronic fabrication; relevant materials, processes, and tools; fabrication of a simple structure in the VLSI clean room/lab. Credit will not be given for ECGR 5140 where credit has been given for ECGR 4140.

ECGR 5142. Power Generation: Operation and Control. (3) Prerequisite(s): ECGR 4142 or equivalent. Characteristics of power generation units, steam, nuclear reactor and hydroelectric. Economic and thermal system dispatch. Transmission losses, load flow problems. Hydro scheduling, hydro-plant models. Energy production cost models. Interchange evaluation. Credit will not be given for ECGR 5142 where credit has been given for ECGR 4190. (Fall) (Alternate years)

ECGR 5143. Dynamic and Transient Analysis of Power Systems. (3) Prerequisite(s): ECGR 4142 or equivalent. Large-scale systems state descriptions and hierarchical control. State space models, dynamic stability and testing. Stability of simple and multi-machine systems. Transient phenomena in electrical power systems. Transient stability problem. Credit will not be given for ECGR 5143 where credit has been given for ECGR 4191.

ECGR 5144. Power Electronics I. (3) Prerequisite(s): Graduate standing and knowledge of fundamentals of electric circuit analysis and electronics, or permission of department. High power solid state circuits. Topics include: power transfer, DC/DC converters, DC/AC inverters for use in resonant converters and motor drives, AC/DC rectifiers, gate-drive circuits for linear and switching amplifiers, pulse-width modulators, introduction to power supply design correction Credit will not be given for ECGR 5144 where credit has been given for ECGR 4144.

ECGR 5146. Introduction to VHDL. (3) Prerequisite(s): ECGR 2182 or equivalent and knowledge of a computer language. Introduction to VHSIC Hardware Description Language (VHDL) including VHDL-based high-level design of microelectronic systems, VHDL programming, and VHDL synthesis; emphasis on learning and using industry-standard VHDL tools running on VNIX workstations. Credit will not be given for ECGR 5146 where credit has been given for ECGR 4146.

ECGR 5161. Control of Robotic Manipulators. (3) Cross-listed Course(s): MEGR 7128 and MEGR 8128. Prerequisite(s): ECGR 4161 and 4111 or their equivalents. Control of industrial robots including linear, nonlinear, and adaptive control of robot's motion plus control of forces and torques exerted by the end-effector. Additional topics include computer animation of the controlled behavior of industrial robots, actuator and sensor types, robot vision, and control computer/robot interfacing. Credit will not be given for ECGR 5161 where credit has been given for ECGR 4162.

ECGR 5165. Laser Electronics I. (3) Prerequisite(s): ECGR 3122 and PHYS 3141 or their equivalents. Basic principles of quantum electronics, interaction of light with atoms, properties of laser light, laser applications. Electromagnetic aspects of lasers, Maxwell's Equations and beam, ray optics, matrix methods for the analysis and synthesis of optical systems. Laser resonator design, oscillations modes, mode frequency and stability. Credit will not be given for ECGR 5165 where credit has been given for ECGR 4165.

ECGR 5171. Introduction to Energy Systems. (3) Prerequisite(s): Graduate standing or permission of the department. Overview of energy systems: energy types, generation, conversion, storage, transportation/transmission, and utilization. Principles, physical structure, processes, and utilization of fossil fuel, nuclear, and renewables for transportation, thermal, and electrical energy generation are discussed along with associated performance metrics. The course also provides an introduction to environmental impacts of energy production, life-cycle analysis, energy efficiency concepts and metrics, transmission systems, grid reliability, and the impact of smart grid technologies. All topics are presented in the context of industry standards as well as federal and state regulations. Credit will not be given for ECGR 5171 where credit has been given for ECGR 4171.

ECGR 5172. Energy Markets. (3) Pre- or Corequisite(s): ECGR 4171 or equivalent; MATH 1241; ECON 2101; or permission of the department. Energy and power systems in regulated and competitive environments and implications on business decisions for firms in these industries. Topics include: mechanism of energy markets; comparative market systems; determination of prices under different market structures; gas, oil, coal, and electricity market architecture; electricity market design; dispatch and new build decisions; smart grid and renewable energy in electricity markets; risk and risk management in energy including demand and price volatility and use of financial derivatives; and the impact of financial market trends and current and proposed policies on the energy industry. Credit will not be given for ECGR 5172 where credit has been given for ECGR 4172.

ECGR 5181. Computer Architecture. (3) Prerequisite(s): ECGR 3183 or permission of the department. Latest research and development in the area of computer architecture; multiprocessor architecture, multi-computers, interconnection networks, branch prediction, instruction-level, data-level and thread-level parallelism, and memory hierarchy; high-performance machines and special purpose

processors. Credit will not be given for ECGR 5181 where credit has been given for ECGR 4181.

ECGR 5182. Digital System Testing. (3) Prerequisite(s): ECGR 3181 with a grade of C or above or permission of department. Introduction to VLSI testing, test process and automatic test equipment, test economics and product quality, test economics, fault modeling, logic and fault simulation, testability measures, combinational and sequential circuit test generation, memory test, analog test, delay test, IDDQ test, design for testability, built-in self test, boundary scan, analog test bus, system test and core test. Credit will not be given for ECGR 5182 where credit has been given for ECGR 4182.

ECGR 5187. Data Communications and Networking II. (3) Prerequisite(s): Principles of data communication networks; computer communications network architecture (layering) with emphasis on the network layer, transport layer, and application layer; local area networks; medium access control; routing; data transport; Internet applications. Credit will not be given for ECGR 5187 where credit has been given for ECGR 4187.

ECGR 5188. Modeling and Analysis of Dynamic Systems. (3) Prerequisite(s): ECGR 3111 or equivalent. Models and dynamical properties of mechanical, thermal, and fluid systems, utilizing by analogy the properties of electrical circuit theory. Emphasis on the formulation of circuit models and the development of terminal equations of system components. Dynamic response to step, pulse, and sinusoidal driving functions using Laplace transforms. Sinusoidal steady-state and frequency response of systems. Credit will not be given for ECGR 5188 where credit has been given for ECGR 4113.

ECGR 5190. Acoustics. (3) Prerequisite(s): ECGR 3122 or equivalent. Vibrations and simple vibrating systems; radiating systems; plane waves of sound; dynamic analogies, microphones and other acoustic transducers; acoustic measurements. Credit will not be given for ECGR 5190 where credit has been given for ECGR 4122.

ECGR 5191. Analog and Digital Communication. (3) Prerequisite(s): ECGR 3111 with a grade of C or above. Analysis and transmission of signals, including analog communication systems (amplitude and frequency modulation); digital communications systems (pulse code modulation and data transmission systems). Credit will not be given for ECGR 5191 where credit has been given for ECGR 4123.

ECGR 5192. Solid State Microelectronic Devices. (3) Cross-listed Course(s): 5392. Prerequisite(s): ECGR 3121 and ECGR 3133, or their equivalents. PN-junctions and Schottky junctions; bipolar and field effect transistors; optoelectronic and heterojunction devices; lithography and integrated circuits; microwave devices; light emitting devices and detectors; quantum devices using superlattices; quantum wells and quantum dots; material preparation and characterization; and measurement techniques. Credit will not be given for ECGR 5192 where credit has been given for ECGR 4134.

ECGR 5193. Power System Analysis I. (3) Prerequisite(s): ECGR 3142 or equivalent. Representation of power system components for analysis studies. Transmission line parameters. Network equations. Load flow analysis and numerical methods. Credit will not be given for ECGR 5193 where credit has been given for ECGR 4141.

ECGR 5194. Power System Analysis II. (3) Prerequisite(s): ECGR 4141 or equivalent. Economic operation of power systems. Short circuit studies. Symmetrical components. Transient stability analysis. Credit will not be given for ECGR 5194 where credit has been given for ECGR 4142.

ECGR 5195. Electrical Machinery. (3) Prerequisite(s): ECGR 3142 or equivalent. Advanced theory of transformers and rotating. Machines; harmonic and saturation effects on machine performance. Unbalanced operation and transient conditions. Credit will not be given for ECGR 5195 where credit has been given for ECGR 4143.

ECGR 5196. Introduction To Robotics. (3) Cross-listed Course(s): MEGR 4127, ENER 5196. Prerequisite(s): ECGR 2103 or equivalent. Modeling of industrial robots including homogeneous transformations, kinematics, velocities, static forces, dynamics, computer animation of dynamic models, motion trajectory planning, and introduction to vision, sensors and actuators. Credit will not be given for ECGR 5196 where credit has been given for either ECGR 4161 or MEGR 4127.

ECGR 5197. Optical Communication. (3) Prerequisite(s): ECGR 4125 or equivalent. Overview of optical fiber, signal degradation in fiber, optical source, optical detectors, optical receiver, optical transmitter, optical network, signal processing, and signal distribution through DWDM and DWDDM. This course also addresses the recent topics in optical communication and optical signal. Credit will not be given for ECGR 5197 where credit has been given for ECGR 4186.

ECGR 5222. Multidimensional Stochastic Signal Processing. (3) Prerequisite(s): ECGR 3111 or permission of department. Review of probability, univariate and multivariate distribution functions, noise modeling, least-squares estimation, non-linear optimization, Markov chains, Bayes theorem; applications.

ECGR 5231. Optical Materials. (3) Prerequisite(s): ECGR 4125 or equivalent. Overview of optical properties of semiconductors and dielectrics, optical waves in crystalline

and periodic structures, optical nonlinearities and their applications in optical frequency conversions, and current topics in optical properties.

ECGR 5261. Microwave Circuit Design I. (3) Prerequisite(s): ECGR 3122 or permission of department. Design and analysis of microwave devices and circuits; Telegrapher's and wave equations; physical transmission lines; circuit analysis techniques; impedance matching techniques; Wilkinson power dividers, hybrid couplers, transformers, and filters. Credit will not be given for ECGR 5261 where credit has been given for ECGR 4261.

ECGR 5265. Microwave Devices and Electronics. (3) Prerequisite(s): ECGR 3122 and PHYS 2231, or their equivalents. Microwave transmission line theory, parameters, microwave waveguides, microstrip line and components including resonators, slow-wave structures, tees, rings, couplers, circulators, isolators, and microwave tubes. Microwave solid state electronics including microwave transistors, tunnel diodes, transferred electron devices, avalanche transit-time devices, and mono-lattice microwave integrated circuits. Credit will not be given for ECGR 5265 where credit has been given for ECGR 4265.

ECGR 5411. Control Systems Theory I. (3) Cross-listed Course(s): ECGR 4111. Prerequisite(s): ECGR 3112 or equivalent with grade of C or above. The fundamentals of modern multi-input-multi-output control systems and preliminary analysis of nonlinear systems via the method of linearization. Time domain analysis of control systems. Design of state-feedback controller via the method of pole-placements. Determining controllability and observability of linear systems. The design and compensation of control systems, Phase lead, lag controller synthesis, Nyquist Stability criterion and frequency domain responses. Credit will not be given for ECGR 5411 where credit has been given for ECGR 4111.

ECGR 5412. Principles of Digital Control Systems. (3) Prerequisite(s): ECGR 3111 or Graduate standing. Introduction to digital control system principles including such topics as z-transform, Laplace transform, and starred transform analysis, pulse transfer functions, digital lag, digital lead, and digital PID controller design, closed-loop stability of digital control systems, and introduction to state-variable methods. Credit will not be given for ECGR 5412 where credit has been given for ECGR 4112.

ECGR 5431. Linear Integrated Electronics. (3) Prerequisite(s): ECGR 3132 or equivalent. Design of linear integrated circuits utilizing bipolar and MOS devices. Application in linear amplifier design, control and processing of analog signals. Power supply regulators, analog switches, and active filters. Credit will not be given for ECGR 5431 where credit has been given for ECGR 4131.

ECGR 5892. Individualized Study. (1 to 6) Individual investigation and exposition of results. *May be repeated for credit.*

ECGR 6021. Advanced Topics in EM and Applications. (3) Cross-listed Course(s): ECGR 8021. Prerequisite(s): permission of department. Possible topics include: advanced boundary value problems; nonlinear magnetic materials; wave guides and resonant cavities; magnetohydrodynamics and plasmas; relativistic effects; charged particle dynamics; radiation. Credit will not be given for ECGR 6021 where credit has been given for ECGR 8021.

ECGR 6090. Special Topics. (1 to 6) Cross-listed Course(s): ECGR 8090. Directed study of current topics of special interest. *May be repeated for credit.*

ECGR 6101. Advanced Computer Graphics. (3) Cross-listed Course(s): ECGR 8101. Prerequisite(s): ECGR 5103 and ECGR 5133, or permission of department. A project-oriented course using and developing techniques of CAD/CAM graphics, hardware and software development. Advanced application of graphics in computer-aided systems design. Credit will not be given for ECGR 6101 where credit has been given for ECGR 8101.

ECGR 6102. Optimization of Engineering Designs. (3) Cross-listed Course(s): ECGR 8102. Prerequisite(s): ECGR 5101 or permission of department. The development of computationally feasible algorithms for solving optimization problems in engineering designs. Introduction to non-linear programming methods; study of constrained and unconstrained problems, linear programming problems and other related topics. Credit will not be given for ECGR 6102 where credit has been given for ECGR 8102.

ECGR 6104. Fabrication of Nanomaterials. (3) Cross-listed Course(s): ECGR 8104, MEGR 7104, and MEGR 8104. Prerequisite(s): NANO 8101 or permission of instructor. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Credit will not be awarded for ECGR 6104 where credit has been awarded for ECGR 8104, MEGR 7104, or MEGR 8104.

ECGR 6111. Linear Systems Theory. (3) Cross-listed Course(s): ECGR 8111. Prerequisite(s): ECGR 4111 or equivalent, and state space concepts and good understanding of linear algebra. Review of linear algebra, Linearization, LTI state-space models, matrix transfer functions, state equation solutions (uniqueness/existence), state transition matrices, stability criteria, observability, controllability, realizations, similarity transforms, canonical

forms, state feedback by eigenvalue-placement, and observer design. Credit will not be given for ECGR 6111 where credit has been given for ECGR 8111.

ECGR 6112. Digital Control Systems. (3) Cross-listed Course(s): ECGR 8112. Prerequisite(s): ECGR 6111 or permission of instructor. Time-domain and Z-domain analysis of linear discrete systems, open and closed loop sampled data systems, engineering characteristics of computer control systems, simulation of system dynamics. Credit will not be given for ECGR 6112 where credit has been given for ECGR 8112.

ECGR 6114. Digital Signal Processing II. (3) Cross-listed Course(s): ECGR 8114. Prerequisite(s): permission of department. Discrete Hilbert Transforms, discrete random signals, effect of finite register length in digital and signal processing, speech processing, radar and other applications. Credit will not be given for ECGR 6114 where credit has been given for ECGR 8114.

ECGR 6115. Optimal Control Theory. (3) Cross-listed Course(s): ECGR 8115. Prerequisite(s): ECGR 6111 or permission of instructor. Review of linear systems, optimal control problems in Lagrange and Mayer forms, Finite and infinite horizon Linear quadratic optimal control, Dynamic Programming and Hamilton-Jacobi-Bellman equations, calculus of variations and Pontryagin's optimality principle, advanced topics (e.g., stochastic optimal control, model predictive control). Credit will not be given for ECGR 6115 where credit has been given for ECGR 8115.

ECGR 6116. Optimal Control Theory II. (3) Cross-listed Course(s): ECGR 8116. Prerequisite(s): ECGR 6115 or permission of department. A continuation of ECGR 6115 with emphasis on stochastic systems. Optimal filtering. Discrete-time Kalman filter and Kalman filter properties. Parameter identification. Multi-variable control systems, system sensitivity and robustness. Credit will not be given for ECGR 6116 where credit has been given for ECGR 8116.

ECGR 6117. Multivariable Controls. (3) Cross-listed Course(s): ECGR 8117. Prerequisite(s): ECGR 6111. Problem of robustness controls, emphasizing computer-oriented approaches; high infinity and algebraic methods current developments. Credit will not be given for ECGR 6117 where credit has been given for ECGR 8117.

ECGR 6118. Applied Digital Image Processing. (3) Cross-listed Course(s): ECGR 8118 and ITCS 6134. Digital image fundamentals; comparison of image transforms including Fourier, Walsh, Hadamard and Cosine; image data compression techniques; image enhancement algorithms; image restoration; image encoding process; image segmentation and description; relationship of hardware restrictions to image fidelity. Credit will not be given for ECGR 6118 where credit has been given for ECGR 8118.

ECGR 6119. Applied Artificial Intelligence. (3) Cross-listed Course(s): ECGR 8119. The theory of machine intelligence. Computational methods for modeling machine intelligence including machine vision and automatic decision making from sensor measurements. Applications of this theory to autonomous robotic decision making such as navigation and industrial quality control. Credit will not be given for ECGR 6119 where credit has been given for ECGR 8119.

ECGR 6120. Wireless Communication and Networking. (3) Cross-listed Course(s): ECGR 8120. Prerequisite(s): Graduate standing. The cellular concept: interference issues, cell layout and planning, control techniques, grade-of-service and system capacity; characteristics of the mobile radio channel and channel models; multiple access techniques in wireless: FDMA, TDMA, and CDMA; analog and digital cellular telephone standards; packet radio systems: description, medium access control, and routing issues. Credit will not be given for ECGR 6120 where credit has been given for ECGR 8120.

ECGR 6121. Advanced Theory of Communications I. (3) Cross-listed Course(s): ECGR 8121. Prerequisite(s): introductory probability course or permission of department. Statistical communications theory and modern communications systems emphasizing modulation and methods of taking into account the effects of noise on various systems. Credit will not be given for ECGR 6121 where credit has been given for ECGR 8121.

ECGR 6122. Advanced Theory of Communications II. (3) Cross-listed Course(s): ECGR 8122. Prerequisite(s): Graduate standing. Continuation of ECGR 6121, including coding and decoding methods. Wave form communications. Applications. Credit will not be given for ECGR 6122 where credit has been given for ECGR 8122.

ECGR 6125. Advanced Topics in Optical Engineering. (3) Cross-listed Course(s): ECGR 8125. Prerequisite(s): ECGR 5125 or permission of department. Overview of optical passive and active devices and discussion of current advances in optical technologies. Credit will not be given for ECGR 6125 where credit has been given for ECGR 8125.

ECGR 6127. Medical Signal Processing. (3) Cross-listed Course(s): ECGR 8127. Fourier methods of medical signal processing. Physics of image formation for different medical imaging modalities including: planar x-ray, computerized tomography (CT), magnetic resonance imaging, and ultrasound. Signal processing techniques for image reconstruction, enhancement, and multimodal fusion. Credit will not be given ECGR 6127 where credit has been given for ECGR 8127.

ECGR 6131. Hybrid Microelectronics. (3) Cross-listed Course(s): ECGR 8131. Prerequisite(s): ECGR 5132 or permission of department. A project-oriented course involving design, bonding, interconnect and testing of a multidie hybrid microelectronics circuit. Emphasis placed upon use of I.C.'s of various technologies in these designs to optimize performance. Credit will not be given for ECGR 6131 where credit has been given for ECGR 8131.

ECGR 6132. Solid State Materials. (3) Cross-listed Course(s): ECGR 8132, OPTI 6371, OPTI 8371, and PHYS 6271. Prerequisite(s): MATH 1242 and PHYS 2102, or equivalents. A review of semiconductor physics, bipolar and unipolar devices, photonic devices and methods of measuring specific device characteristics. Credit will not be given for ECGR 6132 where credit has been given for ECGR 8132.

ECGR 6133. MOS Physics and Technology. (3) Cross-listed Course(s): ECGR 8133. Prerequisite(s): ECGR 6132 or permission of the instructor. The theoretical and practical aspects of the metal oxide semiconductor (MOS) system, its electrical properties, and the measurement and the technology for their control. These topics are developed from simple beginnings to the current state of the art. Credit will not be given for ECGR 6133 where credit has been given for ECGR 8133.

ECGR 6138. Physical Design of VSLI Systems. (3) Cross-listed Course(s): ECGR 8138. Prerequisite(s): ECGR 5133 or equivalent. Synthesis and design of high-speed VLSI circuits; state-of-the-art approaches for circuit simulation; models and techniques for VLSI physical design. Credit will not be given for ECGR 6138 where credit has been given for ECGR 8138.

ECGR 6141. Power System Relaying. (3) Cross-listed Course(s): ECGR 8141. Prerequisite(s): ECGR 4141 or permission of department. Function and principles of protective relaying instrument transformers. Directional, distance and differential relays. Protection of generators, transformers, and transmission lines. Ground fault protection. Computer relaying, algorithms for protective relaying. Credit will not be given for ECGR 6141 where credit has been given for ECGR 8141.

ECGR 6142. Voltage Transients and Surge Protection. (3) Cross-listed Course(s): ECGR 8142. Prerequisite(s): ECGR 4141 or permission of department. Overvoltages due to lightning and switching surges. Traveling waves on transmission lines. Surge arrestors, insulation coordination. Surge protection of transmission lines, substations and rotating machine. Shielding and grounding. Credit will not be given for ECGR 6142 where credit has been given for ECGR 8142.

ECGR 6143. Power System Control. (3) Cross-listed Course(s): ECGR 8143. Prerequisite(s): ECGR 4142 and ECGR 4111, or their equivalents. Computer functions for automatic control of power systems. Automatic generation control, regulation of frequency and tie-line power interchanges. Automatic voltage regulation, excitation system model. Power system dynamics. Computer control centers. Credit will not be given for ECGR 6143 where credit has been given for ECGR 8143.

ECGR 6144. Electric Power Distribution Systems I. (3) Cross-listed Course(s): ECGR 8144. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission from the department. The fundamental principles of the electric power delivery system with emphasis on distribution systems. Examines three-phase unbalanced system and component models, distribution power flow analysis, and radial power flow techniques. Credit will not be given for ECGR 6144 where credit has been given for ECGR 8144.

ECGR 6145. Electric Power Distribution Systems II. (3) Cross-listed Course(s): ECGR 8145. Prerequisite(s): Graduate standing, knowledge of fundamentals of power systems, and ECGR 6144 or ECGR 8144; or permission of department. Focuses on distribution automation and optimization methods applied to distribution systems operation and planning. Credit will not be given for ECGR 6145 where credit has been given for ECGR 8145.

ECGR 6146. Advanced VHDL. (3) Cross-listed Course(s): ECGR 8146. Prerequisite(s): ECGR 5146 or permission of department. Continuation of ECGR 5146. FPGA design with VHDL; VHDL modeling libraries and techniques, and VHDL coding methodology for efficient synthesized. Credit will not be given for ECGR 6146 where credit has been given for ECGR 8146.

ECGR 6147. Power System Stability and Control. (3) Cross-listed Course(s): ECGR 8147. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission of department. The fundamental principles of power system stability with emphasis on modern power grid. Examines various power system stability analyses starting from small signal stability, transient stability, voltage stability, and frequency stability. System dynamics based on various stability conditions and controller design are also discussed. Credit will not be given for ECGR 6147 where credit has been given for ECGR 8147.

ECGR 6151. Advanced Microelectronics Projects. (3) Cross-listed Course(s): ECGR 8151. Prerequisite(s): ECGR 5133. Project-oriented course for the advanced microelectronics student to pursue the testing and simulation at various levels (component, gate, cell and system), as well as the design of a significant VLSI implementation. Credit will not be given for ECGR 6151 where credit has been given for ECGR 8151.

ECGR 6156. Application Specific Integrated Circuit Design. (3) Cross-listed Course(s): ECGR 8156. Prerequisite(s): ECGR 5133 or permission of department. Basic concepts, techniques and CAD tools in Application Specific IC Designs (ASIC); technology of ASIC circuits, method of design, CAD tools, and simulation and verification; practical aspects of design. Credit will not be given for ECGR 6156 where credit has been given for ECGR 8156.

ECGR 6157. CMOS Data Converters. (3) Cross-listed Course(s): ECGR 8157. Prerequisite(s): ECGR 4132, ECGR 5132, or equivalent. Advanced topics in VLSI CMOS data converters including Nyquist and Oversampled architectures. Includes a design project involving the design, system level modeling, circuit simulation, and layout of an analog-to-digital converter. Credit will not be given for ECGR 6157 where credit has been given for ECGR 8157.

ECGR 6171. Simulation of Electronic Materials. (3) Cross-listed Course(s): ECGR 8171. Prerequisite(s): PHYS 6142; and PHYS 4271 or ECGR 4185; or permission of department. Tight-binding theory of periodic solids; bond orbital theory applied the linear and non-linear optical properties of insulators and semiconductors; calculation of vibrational spectra; Green's Function methods for amorphous solids. Simulation of electrically active defeats in solids. Credit will not be given for ECGR 6171 where credit has been given for ECGR 8171.

ECGR 6173. Power Quality. (3) Cross-listed Course(s): ECGR 8173. Prerequisite(s): ECGR 4141, ECGR 5193, or equivalent. Definitions of power quality, types of power quality problems; sources of sags, transient overvoltages and harmonics; distribution overcurrent protection methods and their effect on power quality and reliability; harmonic analysis, principles of controlling harmonics, devices for filtering harmonics; power quality improvement methods. Credit will not be given for ECGR 6173 where credit has been given for ECGR 8173.

ECGR 6181. Embedded Operating Systems. (3) Cross-listed Course(s): ECGR 8181. Pre-/Corequisite(s): ECGR 4101 or ECGR 5101, graduate standing; or permission of instructor. Introduction to the fundamentals of embedded operating systems with an emphasis on real-time performance. A series of labs provides students practical experience on bare metal programming, embedded Linux kernel configuration and initialization, boot loaders, kernel modules, device drivers, and interrupt handlers.

ECGR 6182. Advanced Embedded Operating Systems. (3) Cross-listed Course(s): ECGR 8182. Prerequisite(s): ECGR 6181. An advanced course in embedded operating systems. Lectures cover multiple advanced topics in operating systems. Labs involve developing code for different components of a fully functional operating system kernel. Credit will not be given for ECGR 6182 where credit has been given for ECGR 8182.

ECGR 6183. Multiprocessor Systems Design. (3) Cross-listed Course(s): ECGR 8183. Prerequisite(s): Permission of instructor. Topics include: applications of multiprocessors to digital systems design; hardware/software tradeoff considerations; master/slave, multiple/master and loosely coupled systems; data handling and synchronization problems, networking. Credit will not be given for ECGR 6183 where credit has been given for ECGR 8183.

ECGR 6184. Computer System Engineering. (3) Cross-listed Course(s): ECGR 8184. Topics include: data formats, register transfer operations, computer organization, microprogram control and ALU design. Arithmetic algorithms, I/O organization and memory organization are also covered. Specific emphasis is placed throughout on tradeoffs between hardware and software. Credit will not be given for ECGR 6184 where credit has been given for ECGR 8184.

ECGR 6185. Embedded Commercial Product Design. (3) Cross-listed Course(s): ECGR 8185. Prerequisite(s): ECGR 4101 or ECGR 5101. An advanced course in embedded system design emphasizing the development of hardware sub-systems and software to create commercial products. Architecture, software, and interface techniques. This course is project-oriented, involving the use of software and hardware design tools. Credit will not be given for ECGR 6185 where credit has been given for ECGR 8185.

ECGR 6186. Design for Testability. (3) Cross-listed Course(s): ECGR 8186. Prerequisite(s): ECGR 2181 or permission of department. Fault modeling; test generation using the D-algorithm, PODEM, and FAN; partitioning; scan design, built-in self-testing; testing of array logic; and fault tolerance. Project-oriented course involving the use of logic and fault simulation tools. Credit will not be given for ECGR 6186 where credit has been given for ECGR 8186.

ECGR 6187. Modeling and Analysis of Communication Networks. (3) Cross-listed Course(s): ECGR 8187. Prerequisite(s): Probability theory or permission of department. Communication networks; application of analytical tools for modeling and performance evaluation of these networks, including stochastic processes, Markov models, queuing theory, and teletraffic theory. Credit will not be given for ECGR 6187 where credit has been given for ECGR 8187.

ECGR 6188. Fundamentals of Wireless Systems and Protocols. (3) Cross-listed Course(s): ECGR 8188. Prerequisite(s): Graduate standing and a prior course in data communications or computer networks. Provides an overview of different wireless and mobile network

standards and systems. Covers the distinct characteristics of these wireless systems that require a fundamental redesign of protocols at layer 2 to layer 4 of the network protocol stack. Protocols for medium access control, routing, and reliable transport, in addition to middleware and applications custom-made for wireless networks will be dealt with. Credit will not be given for ECGR 6188 where credit has been given for ECGR 8188.

ECGR 6189. Wireless Sensor Networks. (3) Cross-listed Course(s): ECGR 8189. Prerequisite(s): Graduate standing and knowledge of (a) fundamentals of computer networking, (b) probability and random variables, and (c) C/C++ programming, or permission from the department. Provides the fundamental principles of wireless sensor networks with emphasis on networking protocols and information processing aspects. Reviews basic principles of multi-hop wireless networks and discuss the specific design challenges for the development of networking protocols and applications with wireless sensors. Students go through hands-on tutorials and design projects with programmable wireless sensors. Credit will not be given for ECGR 6189 where credit has been given for ECGR 8189.

ECGR 6190. Smart Grid: Characteristics, Design, and Analysis. (3) Cross-listed Course(s): ECGR 8190. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission from the department. The fundamental principles of the Smart Grid with emphasis on Grid modernization Analysis and design. Examines the design and integration of renewable energy resources to power grid, the impact of power system analysis in the context of smart grid, smart grid observability and controllability, Wide Area Monitoring and Control, Self-Healing network. Credit will not be given for ECGR 6190 where credit has been given for ECGR 8190.

ECGR 6197. Power Electronics II. (3) Cross-listed Course(s): ECGR 8197. Prerequisite(s): Graduate standing, knowledge of fundamentals of power electronics and basics of semiconductor physics, and ECGR 5144, or permission of department. Focuses on more advanced topics in power electronics. Topics include: converter modeling and control, advanced concepts in magnetic circuit design, gate and base drives, switching losses, resonant converters, zero-voltage and zero-current switching, utility-interfaced applications including FACTS, maximum power-point tracking, and power factor correction Credit will not be given for ECGR 6197 where credit has been given for ECGR 8197.

ECGR 6198. Design of Renewable Energy Electromagnetic Devices. (3) Cross-listed Course(s): ECGR 8198. Prerequisite(s): Graduate standing and knowledge of (a) electric machines, (b) electromagnetic, and (c) programming, or permission of department. Introduce modern and classical methods used by engineers to design renewable energy electromagnetic devices, specifically electromagnetic machines. Course separated into two main sections. The first section reviews electromagnetic field theory and introduce the theory behind the finite element method. The second section reviews the theory behind magnetic circuit modeling of electric machines. Emphasis placed on permanent magnet and induction machine design. Credit will not be given for ECGR 6198 where credit has been given for ECGR 8198.

ECGR 6199. Dynamics and Control of AC Drives. (3) Cross-listed Course(s): ECGR 8199. Prerequisite(s): Graduate standing and knowledge of (a) electric machines, (b) power electronics, and (c) programming, or permission of department. An advanced course focusing on studying the theory behind the control of ac drive systems. Topics include: coupled circuit modeling of ac machines, dynamic modeling of induction machines, power converter and converter modeling, the simulation of electric machines and drives, electric drive system control, steady state analysis with non-conventional sources, small signal dynamic response and doubly salient electric machines. Credit will not be given for ECGR 6199 where credit has been given for ECGR 8199.

ECGR 6261. Advanced Topics in Laser Electronics. (3) Cross-listed Course(s): ECGR 8261. Prerequisite(s): ECGR 5165, or permission of instructor. Maxwell-Schrödinger analysis of interactions of light with atoms, Semiclassical laser equations, rate equation approximation. Effects of gain saturation, dispersion, spontaneous emission, and line broadening in laser amplifiers and oscillators. Laser power and frequency calculations. Relaxation oscillations, gain and loss switching, cavity-dumping, and mode-locking. Credit will not be given for ECGR 6261 where credit has been given for ECGR 8261.

ECGR 6263. Advanced Analog Integrated Circuit Design. (3) Cross-listed Course(s): ECGR 8263. Prerequisite(s): ECGR 4132, ECGR 5132 or equivalent. Design of low-noise preamplifiers, advanced operational amplifiers, and other analog CMOS circuits, including analysis of noise and DC mismatch, and design from weak through strong inversion. Includes a design project involving analysis and simulation. Credit will not be given for ECGR 6263 where credit has been given for ECGR 8263.

ECGR 6264. Radio Frequency Design. (3) Cross-listed Course(s): ECGR 8264. Prerequisite(s): permission of instructor. Design and analysis of radio frequency circuits and systems including S-parameters, impedance matching, noise, intermodulation distortion, image rejection, cascade analysis, and incorporation of these methods in the design of modern radio receivers and transmitters. Credit will not be given for ECGR 6264 where credit has been given for ECGR 8264.

ECGR 6265. Neural Networks and Fuzzy Logic. (3) Cross-listed Course(s): ECGR 8265. Topics include: Fuzzy sets, fuzzy logic, fuzzy logic control systems, applications of neural networks, structure adaptive neural network, applications, fuzzy integrated systems, neural networks based fuzzy systems, applications, neural fuzzy controllers, applications in control systems. Credit will not be given for ECGR 6265 where credit has been given for ECGR 8265.

ECGR 6266. Neural Networks Theory and Design. (3) Cross-listed Course(s): ECGR 8266. Topics include: Neural network model and network architectures; single layers, multiple layers network, perceptron learning rules; supervised Hebbian learning; performance optimization; Widrow Hoff learning; backpropagation; associative learning; competitive learning; Grossberg network; Hopfield network; application of neural network. Credit will not be given for ECGR 6266 where credit has been given for ECGR 8266.

ECGR 6437. Mixed-Signal IC Design. (3) Prerequisite(s): permission of department. Design and analysis of mixed-signal integrated circuits and systems including amplifiers, digital circuits, analog-to-digital converters, voltage-controlled oscillators, integrated circuit layout, simulation, and fabrication using modern CAD tools. Students are expected to design, fabricate, and test a mixed-signal integrated circuit.

ECGR 6890. Individualized Study and Projects. (1 to 6) Individual investigation and exposition of results. *May be repeated for credit.*

ECGR 6990. Industrial Internship. (1 to 3) Prerequisite(s): Completion of nine hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director. Requires a mid-term report and final report to be graded by the supervising faculty.

ECGR 6991. Graduate Master Thesis Research. (0 to 6) Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

ECGR 8021. Advanced Topics in EM and Applications. (3) Cross-listed Course(s): ECGR 6021. Prerequisite(s): Permission of department. Possible topics include: advanced boundary value problems; nonlinear magnetic materials; wave guides and resonant cavities; magnetohydrodynamics and plasmas; relativistic effects; charged particle dynamics; radiation. Credit will not be given for ECGR 8021 where credit has been given for ECGR 6021.

ECGR 8090. Special Topics. (1 to 6) Cross-listed Course(s): ECGR 6090. Directed study of current topics of special interest. *May be repeated for credit.*

ECGR 8101. Advanced Computer Graphics. (3) Prerequisite(s): ECGR 5103 and ECGR 5133, or permission of department. A project-oriented course using and developing techniques of CAD/CAM graphics, hardware and software development. Advanced application of graphics in computer-aided systems design. Credit will not be given for ECGR 8101 where credit has been given for ECGR 6101.

ECGR 8102. Optimization of Engineering Designs. (3) Cross-listed Course(s): ECGR 6102. Prerequisite(s): ECGR 5101 or permission of department. The development of computationally feasible algorithms for solving optimization problems in engineering designs. Introduction to non-linear programming methods; study of constrained and unconstrained problems, linear programming problems and other related topics. Credit will not be given for ECGR 8102 where credit has been given for ECGR 6102.

ECGR 8104. Fabrication of Nanomaterials. (3) Cross-listed Course(s): ECGR 6104, MEGR 7104, and MEGR 8104. Prerequisite(s): NANO 8101 or permission of instructor. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Credit will not be awarded for ECGR 8104 where credit has been awarded for ECGR 6104, MEGR 7104, or MEGR 8104.

ECGR 8111. Linear Systems Theory. (3) Prerequisite(s): ECGR 4111 or equivalent, and state space concepts and good understanding of linear algebra. Review of linear algebra, Linearization, LTI state-space models, matrix transfer functions, state equation solutions (uniqueness/existence), state transition matrices, stability criteria, observability, controllability, realizations, similarity transforms, canonical forms, state feedback by eigenvalue-placement, and observer design. Credit will not be given for ECGR 8111 where credit has been given for ECGR 6111.

ECGR 8112. Digital Control Systems. (3) Cross-listed Course(s): ECGR 6112. Prerequisite(s): ECGR 6111, ECGR 8111, or permission of instructor. Time-domain and Z-domain analysis of linear discrete systems, open and closed loop sampled data systems, engineering characteristics of computer control systems, simulation of system dynamics.

Credit will not be given for ECGR 8112 where credit has been given for ECGR 6112.

ECGR 8114. Digital Signal Processing II. (3) Cross-listed Course(s): ECGR 6114. Prerequisite(s): Permission of department. Discrete Hilbert Transforms, discrete random signals, effect of finite register length in digital and signal processing, speech processing, radar and other applications. Credit will not be given for ECGR 8114 where credit has been given for ECGR 6114.

ECGR 8115. Optimal Control Theory. (3) Cross-listed Course(s): ECGR 6115. Prerequisite(s): ECGR 8111 or permission of instructor. Review of linear systems, optimal control problems in Lagrange and Mayer forms, Finite and infinite horizon Linear quadratic optimal control, Dynamic Programming and Hamilton-Jacobi-Bellman equations, calculus of variations and Pontryagin's optimality principle, advanced topics (e.g., stochastic optimal control, model predictive control). Credit will not be given for ECGR 8115 where credit has been given for ECGR 6115.

ECGR 8116. Optimal Control Theory II. (3) Cross-listed Course(s): ECGR 6116. Prerequisite(s): ECGR 6115, ECGR 8115, or permission of department. A continuation of ECGR 8115 with emphasis on stochastic systems. Optimal filtering. Discrete-time Kalman filter and Kalman filter properties. Parameter identification. Multi-variable control systems, system sensitivity and robustness. Credit will not be given for ECGR 8116 where credit has been given for ECGR 6116.

ECGR 8117. Multivariable Controls. (3) Cross-listed Course(s): ECGR 6117. Prerequisite(s): ECGR 6111 or ECGR 8111. Problem of robustness controls, emphasizing computer-oriented approaches; high infinity and algebraic methods current developments. Credit will not be given for ECGR 8117 where credit has been given for ECGR 6117.

ECGR 8118. Applied Digital Image Processing. (3) Cross-listed Course(s): ECGR 6118 and ITCS 6134. Digital image fundamentals; comparison of image transforms including Fourier, Walsh, Hadamard and Cosine; image data compression techniques; image enhancement algorithms; image restoration; image encoding process; image segmentation and description; relationship of hardware restrictions to image fidelity. Credit will not be given for ECGR 8118 where credit has been given for ECGR 6118.

ECGR 8119. Applied Artificial Intelligence. (3) Cross-listed Course(s): ECGR 6119. The theory of machine intelligence. Computational methods for modeling machine intelligence including machine vision and automatic decision making from sensor measurements. Applications of this theory to autonomous robotic decision making such as navigation and industrial quality control. Credit will not be given for ECGR 8119 where credit has been given for ECGR 6119.

ECGR 8120. Wireless Communication and Networking. (3) Cross-listed Course(s): ECGR 6120. Prerequisite(s): Graduate standing. The cellular concept: interference issues, cell layout and planning, control techniques, grade-of-service and system capacity; characteristics of the mobile radio channel and channel models; multiple access techniques in wireless: FDMA, TDMA, and CDMA; analog and digital cellular telephone standards; packet radio systems: description, medium access control, and routing issues. Credit will not be given for ECGR 8120 where credit has been given for ECGR 6120.

ECGR 8121. Advanced Theory of Communications I. (3) Cross-listed Course(s): ECGR 6121. Prerequisite(s): introductory probability course or permission of department. Statistical communications theory and modern communications systems emphasizing modulation and methods of taking into account the effects of noise on various systems. Credit will not be given for ECGR 8121 where credit has been given for ECGR 6121.

ECGR 8122. Advanced Theory of Communications II. (3) Cross-listed Course(s): ECGR 6122. Prerequisite(s): Graduate standing. Continuation of ECGR 8121, including coding and decoding methods. Wave form communications. Applications. Credit will not be given for ECGR 8122 where credit has been given for ECGR 6122.

ECGR 8125. Advanced Topics in Optical Engineering. (3) Cross-listed Course(s): ECGR 6125. Prerequisite(s): ECGR 5125 or permission of department. Overview of optical passive and active devices and discussion of current advances in optical technologies. Credit will not be given for ECGR 8125 where credit has been given for ECGR 6125.

ECGR 8127. Medical Signal Processing. (3) Cross-listed Course(s): ECGR 6127. Fourier methods of medical signal processing. Physics of image formation for different medical imaging modalities including: planar x-ray, computerized tomography (CT), magnetic resonance imaging, and ultrasound. Signal processing techniques for image reconstruction, enhancement, and multimodal fusion. Credit will not be given for ECGR 8127 where credit has been given for ECGR 6127.

ECGR 8131. Hybrid Microelectronics. (3) Cross-listed Course(s): ECGR 6131. Prerequisite(s): ECGR 5132 or permission of department. A project-oriented course involving design, bonding, interconnect and testing of a multidie hybrid microelectronics circuit. Emphasis placed upon use of I.C.'s of various technologies in these designs to optimize performance. Credit will not be given for ECGR 8131 where credit has been given for ECGR 6131.

ECGR 8132. Solid State Materials. (3) Cross-listed Course(s): ECGR 6132, OPTI 6371, OPTI 8371, and PHYS 6271. Prerequisite(s): MATH 1242 and PHYS 2102, or equivalents. The materials covered can be roughly divided into two parts: (I) the basic knowledge of solid state physics: Crystal Structure, Wave Diffraction and the Reciprocal Lattice, Crystal Binding and Elastic Constants, Phonons, Free Electron Fermi Gas, Energy Bands, Semiconductor Crystals, Fermi Surfaces and Metals (approximately the materials of Chapters 1-9 of Kittel's book); (II) Selected application topics: such as Plasmons, Polaritons, and Polarons, Optical Processes and Exciton, Dielectrics and Ferroelectrics, Surface and Interface Physics, Nanostructures (approximately the materials of Chapters 14-18 of Kittel's book). The materials may be supplemented with and replaced by those from other sources. Credit will not be given for ECGR 8132 where credit has been given for ECGR 6132.

ECGR 8133. MOS Physics and Technology. (3) Cross-listed Course(s): ECGR 6133. Prerequisite(s): ECGR 6132, ECGR 8132, or permission of the instructor. The theoretical and practical aspects of the metal oxide semiconductor (MOS) system, its electrical properties, and the measurement and the technology for their control. These topics are developed from simple beginnings to the current state of the art. Credit will not be given for ECGR 8133 where credit has been given for ECGR 6133.

ECGR 8138. Physical Design of VSLI Systems. (3) Cross-listed Course(s): ECGR 6138. Prerequisite(s): ECGR 5133 or equivalent. Synthesis and design of high-speed VLSI circuits; state-of-the-art approaches for circuit simulation; models and techniques for VLSI physical design. Credit will not be given for ECGR 8138 where credit has been given for ECGR 6138.

ECGR 8141. Power System Relaying. (3) Cross-listed Course(s): ECGR 6141. Prerequisite(s): Permission of department. Function and principles of protective relaying instrument transformers. Directional, distance and differential relays. Protection of generators, transformers, and transmission lines. Ground fault protection. Computer relaying, algorithms for protective relaying. Credit will not be given for ECGR 8141 where credit has been given for ECGR 6141.

ECGR 8142. Voltage Transients and Surge Protection. (3) Cross-listed Course(s): ECGR 6142. Prerequisite(s): Permission of department. Overvoltages due to lightning and switching surges. Traveling waves on transmission lines. Surge arrestors, insulation coordination. Surge protection of transmission lines, substations and rotating machine. Shielding and grounding. Credit will not be given for ECGR 8142 where credit has been given for ECGR 6142.

ECGR 8143. Power System Control. (3) Cross-listed Course(s): ECGR 6143. Prerequisite(s): ECGR 4142 and ECGR 4111, or their equivalents. Computer functions for automatic control of power systems. Automatic generation control, regulation of frequency and tie-line power interchanges. Automatic voltage regulation, excitation system model. Power system dynamics. Computer control centers. Credit will not be given for ECGR 8143 where credit has been given for ECGR 6143.

ECGR 8144. Electric Power Distribution Systems I. (3) Cross-listed Course(s): ECGR 6144. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission of department. The fundamental principles of the electric power delivery system with emphasis on distribution systems. Examines three-phase unbalanced system and component models, distribution power flow analysis, and radial power flow techniques. Credit will not be given for ECGR 8144 where credit has been given for ECGR 6144.

ECGR 8145. Electric Power Distribution Systems II. (3) Cross-listed Course(s): ECGR 6145. Prerequisite(s): Graduate standing, knowledge of fundamentals of power systems, and ECGR 6144 or ECGR 8144; or permission of department. Focuses on distribution automation and optimization methods applied to distribution systems operation and planning. Credit will not be given for ECGR 8145 where credit has been given for ECGR 6145.

ECGR 8146. Advanced VHDL. (3) Cross-listed Course(s): ECGR 6146. Prerequisite(s): ECGR 5146 or permission of department. Continuation of ECGR 5146. FPGA design with VHDL; VHDL modeling libraries and techniques, and VHDL coding methodology for efficient synthesized. Credit will not be given for ECGR 8146 where credit has been given for ECGR 6146.

ECGR 8147. Power System Stability and Control. (3) Cross-listed Course(s): ECGR 6146. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission of department. The fundamental principles of power system stability with emphasis on modern power grid. Examines various power system stability analyses starting from small signal stability, transient stability, voltage stability, and frequency stability. System dynamics based on various stability conditions and controller design are also discussed. Credit will not be given for ECGR 8147 where credit has been given for ECGR 6147.

ECGR 8151. Advanced Microelectronics Projects. (3) Cross-listed Course(s): ECGR 6151. Prerequisite(s): ECGR 5133. Project-oriented course for the advanced microelectronics student to pursue the testing and simulation at various levels (component, gate, cell and system), as well as the design of a significant VLSI

implementation. Credit will not be given for ECGR 8151 where credit has been given for ECGR 6151.

ECGR 8156. Application Specific Integrated Circuit Design. (3) Cross-listed Course(s): ECGR 6156 Prerequisite(s): ECGR 5133 or permission of department. Basic concepts, techniques and CAD tools in Application Specific IC Designs (ASIC); technology of ASIC circuits, method of design, CAD tools, and simulation and verification; practical aspects of design. Credit will not be given for ECGR 8156 where credit has been given for ECGR 6156.

ECGR 8157. CMOS Data Converters. (3) Cross-listed Course(s): ECGR 6157. Prerequisite(s): ECGR 4132, ECGR 5132, or equivalent. Advanced topics in VLSI CMOS data converters including Nyquist and Oversampled architectures. Includes a design project involving the design, system level modeling, circuit simulation, and layout of an analog-to-digital converter. Credit will not be given for ECGR 8157 where credit has been given for ECGR 6157.

ECGR 8171. Simulation of Electronic Materials. (3) Cross-listed Course(s): ECGR 6171. Prerequisite(s): PHYS 6142; and PHYS 4271 or ECGR 4185; or permission of department. Tight-binding theory of periodic solids; bond orbital theory applied the linear and non-linear optical properties of insulators and semiconductors; calculation of vibrational spectra; Green's Function methods for amorphous solids. Simulation of electrically active defeats in solids. Credit will not be given for ECGR 8171 where credit has been given for ECGR 6171.

ECGR 8173. Power Quality. (3) Cross-listed Course(s): ECGR 6173. Prerequisite(s): ECGR 4141, ECGR 5193, or equivalent. Definitions of power quality, types of power quality problems; sources of sags, transient overvoltages and harmonics; distribution overcurrent protection methods and their effect on power quality and reliability; harmonic analysis, principles of controlling harmonics, devices for filtering harmonics; power quality improvement methods. Credit will not be given for ECGR 8173 where credit has been given for ECGR 6173.

ECGR 8181. Embedded Operating Systems. (3) Cross-listed Course(s): ECGR 6181. Pre-/Corequisite(s): ECGR 4101 or ECGR 5101, graduate standing; or permission of instructor. Introduction to the fundamentals of embedded operating systems with an emphasis on real-time performance. A series of labs provides students practical experience on bare metal programming, embedded Linux kernel configuration and initialization, boot loaders, kernel modules, device drivers, and interrupt handlers.

ECGR 8182. Advanced Embedded Operating Systems. (3) Cross-listed Course(s): ECGR 6182. Prerequisite(s): ECGR 6181 or ECGR 8181. An advanced course in embedded operating systems. Lectures cover multiple advanced topics in operating systems. Labs involve developing code for different components of a fully functional operating system kernel. Credit will not be given for ECGR 8182 where credit has been given for ECGR 6182.

ECGR 8183. Multiprocessor Systems Design. (3) Cross-listed Course(s): ECGR 6183. Prerequisite(s): ECGR 3184 or equivalent, or permission of instructor. Topics include: applications of multiprocessors to digital systems design; hardware/software tradeoff considerations; master/slave, multiple/master and loosely coupled systems; data handling and synchronization problems, networking. Credit will not be given for ECGR 8183 where credit has been given for ECGR 6183.

ECGR 8184. Computer System Engineering. (3) Cross-listed Course(s): ECGR 6184. Topics include: data formats, register transfer operations, computer organization, microprogram control and ALU design. Arithmetic algorithms, I/O organization and memory organization are also covered. Specific emphasis is placed throughout on tradeoffs between hardware and software. Credit will not be given for ECGR 8184 where credit has been given for ECGR 6184.

ECGR 8185. Embedded Commercial Product Design. (3) Cross-listed Course(s): ECGR 6185. Prerequisite(s): ECGR 4101 or ECGR 5101. An advanced course in embedded system design emphasizing the development of hardware sub-systems and software to create commercial products. Architecture, software, and interface techniques. This course is project-oriented, involving the use of software and hardware design tools. Credit will not be given for ECGR 8185 where credit has been given for ECGR 6185.

ECGR 8186. Design for Testability. (3) Cross-listed Course(s): ECGR 6186. Prerequisite(s): ECGR 2181 or permission of department. Fault modeling; test generation using the D-algorithm, PODEM, and FAN; partitioning; scan design, built-in self-testing; testing of array logic; and fault tolerance. Project-oriented course involving the use of logic and fault simulation tools. Credit will not be given for ECGR 8186 where credit has been given for ECGR 6186.

ECGR 8187. Modeling and Analysis of Communication Networks. (3) Cross-listed Course(s): ECGR 6187. Prerequisite(s): Probability theory or permission of department. Communication networks; application of analytical tools for modeling and performance evaluation of these networks, including stochastic processes, Markov models, queuing theory, and teletraffic theory. Credit will not be given for ECGR 8187 where credit has been given for ECGR 6187.

ECGR 8188. Fundamentals of Wireless Systems and Protocols. (3) Cross-listed Course(s): ECGR 6188.

Prerequisite(s): Graduate standing and a prior course in data communications or computer networks. Provides an overview of different wireless and mobile network standards and systems. Covers the distinct characteristics of these wireless systems that require a fundamental redesign of protocols at layer 2 to layer 4 of the network protocol stack. Protocols for medium access control, routing, and reliable transport, in addition to middleware and applications custom-made for wireless networks will be dealt with. Credit will not be given for ECGR 8188 where credit has been given for ECGR 6188.

ECGR 8189. Wireless Sensor Networks. (3) Cross-listed Course(s): ECGR 6189. Prerequisite(s): Graduate standing and knowledge of (a) fundamentals of computer networking, (b) probability and random variables, and (c) C/C++ programming, or permission from the department. Provides the fundamental principles of wireless sensor networks with emphasis on networking protocols and information processing aspects. Reviews basic principles of multi-hop wireless networks and discuss the specific design challenges for the development of networking protocols and applications with wireless sensors. Students go through hands-on tutorials and design projects with programmable wireless sensors. Credit will not be given for ECGR 8189 where credit has been given for ECGR 6189.

ECGR 8190. Smart Grid: Characteristics, Design, and Analysis. (3) Cross-listed Course(s): ECGR 6190. Prerequisite(s): Graduate standing and knowledge of fundamentals of power systems, or permission from the department. The fundamental principles of the Smart Grid with emphasis on Grid modernization Analysis and design. Examines the design and integration of renewable energy resources to power grid, the impact of power system analysis in the context of smart grid, smart grid observability and controllability, Wide Area Monitoring and Control, Self-Healing network. Credit will not be given for ECGR 8190 where credit has been given for ECGR 6190.

ECGR 8197. Power Electronics II. (3) Cross-listed Course(s): ECGR 6197. Prerequisite(s): Graduate standing, knowledge of fundamentals of power electronics and basics of semiconductor physics, and ECGR 5144, or permission of department. Focuses on more advanced topics in power electronics. Topics include: converter modeling and control, advanced concepts in magnetic circuit design, gate and base drives, switching losses, resonant converters, zero-voltage and zero-current switching, utility-interfaced applications including FACTS, maximum power-point tracking, and power factor correction Credit will not be given for ECGR 8197 where credit has been given for ECGR 6197.

ECGR 8198. Design of Renewable Energy Electromagnetic Devices. (3) Cross-listed Course(s): ECGR 6198. Prerequisite(s): Graduate standing and knowledge of (a) electric machines, (b) electromagnetic, and (c) programming, or permission of department. Introduce modern and classical methods used by engineers to design renewable energy electromagnetic devices, specifically electromagnetic machines. Course separated into two main sections. The first section reviews electromagnetic field theory and introduce the theory behind the finite element method. The second section reviews the theory behind magnetic circuit modeling of electric machines. Emphasis placed on permanent magnet and induction machine design. Credit will not be given for ECGR 8198 where credit has been given for ECGR 6198.

ECGR 8199. Dynamics and Control of AC Drives. (3) Cross-listed Course(s): ECGR 6199. Prerequisite(s): Graduate standing and knowledge of (a) electric machines, (b) power electronics, and (c) programming, or permission of department. An advanced course focusing on studying the theory behind the control of ac drive systems. Topics include: coupled circuit modeling of ac machines, dynamic modeling of induction machines, power converter and converter modeling, the simulation of electric machines and drives, electric drive system control, steady state analysis with non-conventional sources, small signal dynamic response and doubly salient electric machines. Credit will not be given for ECGR 8199 where credit has been given for ECGR 6199.

ECGR 8261. Advanced Topics in Laser Electronics. (3) Cross-listed Course(s): ECGR 6261. Prerequisite(s): ECGR 5165 or permission of instructor. Maxwell-Schrödinger analysis of interactions of light with atoms, Semiclassical laser equations, rate equation approximation. Effects of gain saturation, dispersion, spontaneous emission, and line broadening in laser amplifiers and oscillators. Laser power and frequency calculations. Relaxation oscillations, gain and loss switching, cavity-dumping, and mode-locking. Credit will not be given for ECGR 8261 where credit has been given for ECGR 6261.

ECGR 8263. Advanced Analog Integrated Circuit Design. (3) Cross-listed Course(s): ECGR 6263. Prerequisite(s): ECGR 4132, ECGR 5132, or equivalent. Design of low-noise preamplifiers, advanced operational amplifiers, and other analog CMOS circuits, including analysis of noise and DC mismatch, and design from weak through strong inversion. Includes a design project involving analysis and simulation. Credit will not be given for ECGR 8263 where credit has been given for ECGR 6263.

ECGR 8264. Radio Frequency Design. (3) Cross-listed Course(s): ECGR 6264. Prerequisite(s): Permission of instructor. Design and analysis of radio frequency circuits and systems including S-parameters, impedance matching, noise, intermodulation distortion, image rejection, cascade analysis, and incorporation of these methods in the design

of modern radio receivers and transmitters. Credit will not be given for ECGR 8264 where credit has been given for ECGR 6264.

ECGR 8265. Neural Networks and Fuzzy Logic. (3) Cross-listed Course(s): ECGR 6265. Topics include: Fuzzy sets, fuzzy logic, fuzzy logic control systems, applications of neural networks, structure adaptive neural network, applications, fuzzy integrated systems, neural networks based fuzzy systems, applications, neural fuzzy controllers, applications in control systems. Credit will not be given for ECGR 8265 where credit has been given for ECGR 6265.

ECGR 8266. Neural Networks Theory and Design. (3) Cross-listed Course(s): ECGR 6266. Topics include: Neural network model and network architectures; single layers, multiple layers network, perceptron learning rules; supervised Hebbian learning; performance optimization; Widrow Hoff learning; backpropagation; associative learning; competitive learning; Grossberg network; Hopfield network; application of neural network. Credit will not be given for ECGR 8266 where credit has been given for ECGR 6266.

ECGR 8890. Individualized Study and Projects. (1 to 6) Individual investigation and exposition of results. *May be repeated for credit.*

ECGR 8990. Industrial Internship. (1 to 3) Prerequisite(s): Completion of nine hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director. Requires a mid-term report and final report to be graded by the supervising faculty.

ECGR 8999. Doctoral Dissertation Research. (0 to 9) Individual investigation culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Economics (ECON)

ECON 5116. Public Finance. (3) Revenue and expenditure problems of governmental units, intergovernmental financial relationships and the impact of federal fiscal policy upon the American economy.

ECON 5135. Economics of Growth and Development. (3) Theories of economic growth and development applied to varying economic and social systems. Current theoretical models and their relevance to efficient allocation of resources to both the developed and the developing nations.

ECON 5160. Economics of Transportation. (3) Analysis of transportation systems. Topics include: the historical development of various modes, costs and rate-making, regulation and national transportation policy.

ECON 5171. Economics of International Trade. (3) Theory of international trade including determination of international trade patterns, welfare implications of international trade, economic integration, and effects of tariffs and quotas.

ECON 5172. Economics of International Finance. (3) Survey of international monetary theory. Topics include: exchange rate determination, balance of payments and adjustment, international liquidity, capital movements, international financial organizations, and monetary reform proposals.

ECON 5180. Industrial Organization and Public Policy. (3) An examination of monopolistic competition, oligopoly, and monopoly and questions of public policy in dealing with problems created by industrial concentration.

ECON 5181. Energy and Environmental Economics. (3) Economic issues of both energy and environment. Energy issues include the historical development of energy resources, supply and demand considerations, and projections of the future energy balance. Environmental issues are externalities, common property resources, and government regulation. Policy considerations include environmental standards, pollution charges, and property rights. Cost-benefit analysis and microeconomic theory are applied.

ECON 6001. Advanced Topics in Macroeconomics. (3) Prerequisite(s): ECON 6112, ECON 6201, and ECON 6202. Advanced treatment of selected issues in macroeconomics.

ECON 6002. Advanced Topics in Microeconomics. (3) Prerequisite(s): ECON 6112, ECON 6201, and ECON 6202. Advanced treatment of selected issues in microeconomics.

ECON 6090. Topics in Economics. (1 to 3) Prerequisite(s): permission of the department. Topics from various areas of economics. Credit hours will vary with the topic offered. *May be repeated for credit with change in topic.*

ECON 6100. Graduate Mathematical Economics. (3) Economic problems are analyzed with quantitative techniques. Topics covered include the study of economic growth models, utility maximization,

homogeneous functions, dynamic systems, applications of linear programming, and constrained optimization.

ECON 6112. Graduate Econometrics. (3) Cross-listed Course(s): DSBA 6112. Prerequisite(s): Admission to graduate program and permission of Graduate Program Director. Advanced study of the theory and application of statistics to economic problems. Topics include: derivation of least-squares estimators; maximum likelihood estimation; and problems of multicollinearity, heteroskedasticity, and autocorrelation.

ECON 6113. Cross-Section and Time-Series Econometrics. (3) Cross-listed Course(s): STAT 6113. Prerequisite(s): Permission of Graduate Program Director. Introduces the advanced study of the theory and application of statistics to economic problems. Topics include: derivation of the least-squares estimator; methods with which to detect and correct for potential problems with the classical regression model; maximum likelihood estimation; instrumental variables regression; the problems with multicollinearity, heteroscedasticity, and autocorrelation; introduction to the time-series estimation, including ARIMA models and basic forecasting tools.

ECON 6201. Advanced Macroeconomic Theory. (3) Cross-listed Course(s): PPOL 8701. Prerequisite(s): Admission to graduate program and permission of Graduate Program Director. Theories of aggregate income determination, inflation, unemployment, interest rates and economic growth; macro-economic consumption and investment behavior; the business cycle.

ECON 6202. Advanced Microeconomic Theory. (3) Cross-listed Course(s): PPOL 8703. Prerequisite(s): Admission to graduate program and permission of Graduate Program Director. Theories of the firm, of the consumer, and of resource owners; determination of prices under different market structures; general equilibrium analysis and welfare economics.

ECON 6203. Financial Economic Theory. (3) Cross-listed Course(s): FINN 6203. Prerequisite(s): Admission to the graduate program and permission of Program Director. The fundamental principles of risk pricing and risk allocation in a unified framework. Discrete-time model is employed to underscore the relationship between the techniques used in finance and the economic analysis of risk. The objective is to understand the economics of asset pricing and how derivatives and options are used in practice and their limitations.

ECON 6206. Game Theory and Experiments. (3) Cross-listed Course(s): PPOL 8707. Prerequisite(s): Permission of the Graduate Program Director. Focuses on game theoretic analysis and the experimental methodology which can be used to test game theoretic models. The primary topics in game theory include: static games with complete information, dynamic games with complete information, static games with incomplete information, and dynamic games with incomplete information. Some topics are introduced by way of an economic experiment, and the experiment is followed by a rigorous analysis of the game theoretic solution to the game. The latter part of the course focuses on how to design economic experiments as a means of testing the predictions of game theoretic models.

ECON 6217. Advanced Microeconometrics. (3) Prerequisite(s): ECON 6112 or ECON 6113. Underlying assumptions regarding the population, specification, estimation, and testing of microeconometric models. Students become acquainted with a variety of extensions of conventional linear models for cross-sectional and panel data, including, but not limited to: panel data models, instrumental variables models, and qualitative response models.

ECON 6218. Advanced Business and Economic Forecasting. (3) Prerequisite(s): ECON 6112. Develops forecasting techniques used in business decision making and techniques used in forecasting macroeconomic variables. Topics include: estimation, identification and prediction using ARMAX, state space, and Box-Jenkins models; spectral analysis; linear filtering.

ECON 6219. Financial Econometrics. (3) Cross-listed Course(s): FINN 6219. Prerequisite(s): ECON 6113, ECON 6218, or MATH 6201. Advanced time series with financial applications. Topics include: time series regressions (univariate and multivariate, stationary and non-stationary) and time series models (including ARMA, ARCH, GARCH, stochastic volatility and factor models). The emphasis will be on model properties, estimators, test statistics, and applications in finance.

ECON 6235. Monetary and Financial Theory. (3) Cross-listed Course(s): PPOL 8711. Prerequisite(s): ECON 6201 or ECON 6202, and ECON 6112. Theory and empirical tests of money supply, money demand, and financial markets; portfolio theory with special attention to portfolio choices of banks; term structure of interest rates; dynamic models of money and economic activity.

ECON 6238. Real Estate and Urban Economics. (3) Prerequisite(s): ECON 2102. Cross-listed Course(s): MBAD 6238 and MSRE 6238. Focuses on the fundamental economic forces that create urban areas, with a special emphasis on land markets. Integrates economic theory to better understand the market forces that impact applied real estate development projects. Topics include: urban growth and development; land valuation; the modelling and estimation of agglomeration economies; the costs of cities and their internal structure with emphasis on land use

regulations and transportation; amenities and the local supply of labor; the sizes and functions of cities; affordable housing; and local public finance.

ECON 6240. Economics of International Finance. (3) Prerequisite(s): ECON 6201, ECON 6202, and ECON 6112. Open economy macroeconomics, international transmission of inflation and unemployment, internal and external balance; balance of payments and international payments mechanisms; determination of exchange rates and effects of hedging and speculation.

ECON 6241. Economics of International Trade. (3) Prerequisite(s): ECON 6201, ECON 6202, and ECON 6112. Examines the causes and consequences of trade using Ricardian and neoclassical models. Considers extensions, modifications, and empirical tests of these models. Analysis of tariffs, quotas, other trade restrictions, export subsidies, and trends in current trade policy.

ECON 6250. Advanced Urban and Regional Economics. (3) Cross-listed Course(s): PPOL 8705. Prerequisite(s): Admission to graduate program. Applications of microeconomic theory to problems of cities, metropolitan areas and regions; methods in regional analysis, location theory, land-use planning, measurement of economic activity; transportation, housing, poverty, and growth issues.

ECON 6255. Benefit-Cost Analysis. (3) Principles, practices, and applications for defining and comparing the benefits and costs of public policy programs and private sector projects, including techniques useful for organizing and analyzing data, evaluating programs systematically, and developing a framework for decision making while recognizing ethical implications, measurement problems, and time value problems.

ECON 6256. Public Economics. (3) Cross-listed Course(s): PPOL 8709. Prerequisite(s): MATH 1241 or equivalent, and permission of the Graduate Program Director. Public economics is the study of the way governments choose spending, taxation, and regulatory policy; the ways such policies may affect economic welfare; and mechanisms to evaluate the economic effects of such policies.

ECON 6257. Applied Computational Economics. (3) Prerequisite(s): ECON 6201 and ECON 6202, or permission of the Graduate Program Director. Introduction to computational approaches for solving economic models. Topics include: interpolation and approximation techniques, numerical optimization, numerical solutions to systems of nonlinear equations, quadrature formulas for numerical integration, Monte Carlo simulation, and basic solution algorithms for economic dynamics.

ECON 6260. Economics of Health and Healthcare. (3) Cross-listed Course(s): PPOL 8667 and HSRD 8203. Prerequisite(s): Admission to graduate program or permission of the instructor. Uses economic theory and econometrics to analyze the functioning of the health care sector and appropriate public policy. Topics include: how markets for medical care differ from other markets, the demand for medical care, the demand and supply of health insurance, the role of competition in medical markets, managed care, managed competition, and the role of the public sector in regulating and financing health care. The topic list is flexible, and student input will be solicited and welcomed.

ECON 6800. Directed Study in Economics. (1 to 3) Prerequisite(s): Admission to graduate program. Independent study of a theoretical and/or a policy problem in a special area of economics. Topics of the investigation may originate from the student or from the faculty member supervising the study. *May be repeated for credit up to 6 credits and permission of Graduate Program Director.*

ECON 6901. Research Methods for Economists I. (3) Prerequisite(s): ECON 6112 or ECON 6113; and either ECON 6201, ECON 6202, or ECON 6203. Research programs in economics; problem identification; interpretation of statistical results; bibliographic search; data sources and collection; selection of statistical technique; preparation of reports and proposals.

ECON 6902. Research Methods for Economists II. (3) Prerequisite(s): ECON 6901. Critique of economic research and reports, presentation of econometric results and reports. The student will develop a research project, perform statistical tests, and present the results orally and in a major research paper.

ECON 6999. Graduate Thesis Research. (1 to 6) Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

Education: Curriculum and Instruction (EDCI)

EDCI 6120. Critical Media Pedagogy and Urban Education. (3) Introduces teacher leaders to methods for developing effective and engaging curricula that focuses on the integration of 21st century cutting-edge technology with critical pedagogical practices. This course aims to demystify contemporary uses of new media (e.g., smartphones, blogs, social networking, video sharing/digital filmmaking, gaming, etc.) in urban classrooms, by

demonstrating how critical media education can supplement traditional approaches to learning. Teacher leaders are exposed to research on varied pedagogical methodologies, which have: (a) supported the development of more culturally responsive instruction; (b) provided evidence of increases in students' motivation to achieve, and (c) facilitated social consciousness and social action.

EDCI 6201. Perspectives in Immigration and Urban Education. (3) Cross-listed Course(s): EDCI 8201. Examines theories, issues, policies and historical trends in the education of immigrant students in urban public schools. Topics include: theories of immigrant adaptation in relation to race, gender, social class, language learning, and immigration status, demographic trends and their influence on urban schools and on teacher preparation, broader political influences on immigrant education, and the role of family and community in shaping immigrant students' educational trajectories. Students critically analyze scholarly research and theoretical work related to immigration and education in variety of fields.

EDCI 8004. Topics in Analysis. (3) Cross-listed Course(s): MATH 6004. Prerequisite(s): Permission of department. Topics in analysis selected so as to complement regular course offerings in this area of mathematics. *May be repeated for credit with change of topic.*

EDCI 8008. Topics in Geometry and Topology. (3) Cross-listed Course(s): MATH 6008. Topics selected from Euclidean geometry, non-Euclidean geometry, projective geometry, differential geometry, point-set topology, algebraic topology. *May be repeated for credit with change of topic.*

EDCI 8020. Topics in English Education. (3) Examination of special topics germane to English education in urban-regional environments at the elementary, middle, and secondary school levels as well as the community and four-year college, including historical perspectives on current problems, effectiveness of programs and practices in urban schools, and emerging theories on teaching and learning. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

EDCI 8040. Topics in Reading Education. (3) Cross-listed Course(s): READ 6000. Examination of special topics germane to reading education in urban-regional environments at the elementary, middle, and secondary school levels as well as the community and four-year college, including historical perspectives on current problems, effectiveness of programs and practices in urban schools, and emerging theories of learning. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

EDCI 8061. Topics in Urban Educational Research. (3) Examination of the research in specific areas germane to urban educational settings and problems. Emphasis on different research questions and methodologies used to investigate similar problems. Examination of alignment of research findings with educational change in urban environments of the elementary, middle, and secondary school levels as well as the community and four-year college. *May be repeated for credit with change of topic.*

EDCI 8070. Topics in Urban Educational Leadership. (3) Examination of special topics germane to leadership in urban education environments at the elementary, middle, and secondary school levels as well as the community and four-year college. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

EDCI 8075. Topics in Urban-Regional Education. (3) Examination of special topics germane to education in urban-regional environments at the elementary, middle, and secondary school levels as well as the community and four-year college. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

EDCI 8080. Topics in Curriculum, Instruction, and Educator Development. (3) Special topics germane to curriculum and instruction in education environments at the elementary, middle, and secondary school levels, as well as the community and four-year college. Also examined are specific areas of teacher preparation, professional learning, and educator development. The course has extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

EDCI 8084. Topics and Research in Social Studies Education. (3) Cross-listed Course(s): ELED 6241, MDSK 6254, and MDSK 6354. Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program or permission of Department of Middle, Secondary, and K-12 Education. An introduction to and analysis of research in social studies curriculum, instruction, and educator development. Provides an overview of contemporary research perspectives and paradigms in the social studies, including civics, economics, geography, history, and social science education and a survey of critical and justice-oriented theoretical frameworks in social studies. Opportunities are presented to interpret and synthesize the social studies research literature, examine social studies curriculum history and trends, and explore development of classroom-based research studies in the social studies.

EDCI 8101. Foundations of Mathematics. (3) Cross-listed Course(s): MATH 6101. Prerequisite(s): Permission of department. Introduction to the fundamentals of set theory and logic. Topics include: theorem proving, sets, functions, relations, and constructing number systems.

EDCI 8102. Real Analysis for Secondary Mathematics Teachers. (3) Cross-listed Course(s): MATH 6102. Prerequisite(s): EDCI 8101 or MATH 6101, and permission of department. Provides a theoretical understanding of the basics of real analysis. Topics include: limits and continuity, derivatives, integrals, and Taylor series.

EDCI 8103. Computer Techniques and Numerical Methods. (3) Cross-listed Course(s): MATH 6103. Prerequisite(s): Permission of department. Computer systems, programming, and the computer solution of numerical problems.

EDCI 8105. Problem Solving in Discrete Mathematics. (3) Cross-listed Course(s): MATH 6105. Propositional and predicate calculus, counting techniques, partially ordered sets, lattices, graphs, and trees.

EDCI 8106. Modern Algebra for Secondary Mathematics Teachers. (3) Cross-listed Course(s): MATH 6106. Prerequisite(s): MATH 3163 or its equivalent or permission of department. Topics chosen from group theory, rings and ideals, integral domains, fields and elementary Galois theory.

EDCI 8107. Linear Algebra for Secondary Mathematics Teachers. (3) Cross-listed Course(s): MATH 6107. Prerequisite(s): MATH 2164 or its equivalent or permission of department. Systems of linear equations, matrices, vector spaces, linear transformations, determinants, canonical forms of matrices, inner products.

EDCI 8112. Theoretical Foundations of Learning Mathematics. (3) Cross-listed Course(s): MAED 6122. Introductions to theories of learning that have influenced the teaching of mathematics in K-12. An overview of theories that have guided reforms in mathematics teaching; contemporary constructivist theories of mathematics learning.

EDCI 8113. Research in Mathematics Education. (3) Cross-listed Course(s): MAED 6123. An introduction and overview of research in the teaching and learning of mathematics in K-12. Overview of contemporary research perspectives and paradigms; interpreting and synthesizing the research literature; survey of contemporary research problems in mathematics teaching and learning; development of classroom-based research studies.

EDCI 8114. Advanced Topics in Mathematics Education. (3) Prerequisite(s): Enrollment in the Mathematics Education specialization of the Doctoral Program in Curriculum and Instruction. Advanced research topics in the teaching and learning of mathematics. Includes a survey, interpretation, and synthesis of contemporary research problems in mathematics teaching and learning. *May be repeated for credit with change of topic.*

EDCI 8115. Issues in the Teaching of Secondary School Mathematics. (3) Cross-listed Course(s): MAED 6124. Prerequisite(s): Students must be enrolled in the M.A. in Mathematics Education Program. Study of major issues affecting secondary mathematics education: analysis of the impact of learning theories on methods of teaching; assessment methods for improving mathematics learning; analysis of the historical and programmatic development of the secondary school mathematics curriculum leading to current trends, issues, and problems; and analysis of the role of technology in the secondary mathematics classroom.

EDCI 8118. Non-Euclidean Geometry. (3) Cross-listed Course(s): MATH 6118. History of Euclid's Fifth Postulate and attempts to prove it; work of Gauss, Bolyai, Lobachevsky and others; systematic development of hyperbolic geometry; relative consistency of hyperbolic geometry; relative consistency of hyperbolic and Euclidean geometries.

EDCI 8120. Literacy and Educational Public Policy. (3) Examination of competing definitions of literacy and development of literacy practices related to debates in American education public policy about the ends of schooling, the strategies of teaching, and the priorities of the language arts curricula. Evaluation of assumptions, reasoning, and research bases linking literacy to policy. Study of the historical and current methods of establishing district, statewide and federal policies about literacy education programs, materials, personnel, grants, and licensure.

EDCI 8121. Applied Research Methods in the Teaching of English. (3) Cross-listed Course(s): ENGL 6674. Provides the opportunity to apply research methods in classrooms. Examine identities as readers, writers, teachers, and especially as classroom researchers.

EDCI 8129. Linguistics and Language Learning. (3) Cross-listed Course(s): ENGL 5263. Readings in, discussions of, and application of linguistically oriented theories of language acquisition, directed toward gaining an understanding of language-learning processes and stages.

EDCI 8131. Research in English Studies. (3) Cross-listed Course(s): ENGL 6101. The discipline of English--its nature, its history, and its methods. Emphasis on (1) the interrelations of literature, language, and writing; and (2) the diversity of cultural origins and critical perspectives in

English studies, with concentration on selected major critical approaches. Intensive writing and practice in methods of research.

EDCI 8132. Research in Literary Theory. (3) Cross-listed Course(s): ENGL 6102. Modern literary theory focusing on the theoretical concepts which underpin literary analysis. Emphases may differ from semester to semester; readings will focus on major theoretical statements and on criticism which applies several approaches to particular literary works. Students are required to apply what they have learned.

EDCI 8133. Multiculturalism and Children's Literature. (3) Cross-listed Course(s): ENGL 6104. Focuses on significant authors, illustrators, or themes in children's and/or adolescent literature.

EDCI 8134. Early Black American Literature. (3) Cross-listed Course(s): ENGL 6147. A survey of African-American literature, emphasizing the major authors, those relevant historical and social factors, and those specific literary movements that have influenced the development of African-American literature.

EDCI 8135. African American Literary Theory and Criticism. (3) Cross-listed Course(s): ENGL 5158. Prerequisite(s): ENGL 2301, ENGL 3100, and ENGL 3200, or permission of instructor or graduate status. History of an African American approach to literary analysis, including a practicum in modern criticism.

EDCI 8137. Language and Culture. (3) Cross-listed Course(s): ENGL 6165. An introduction to learner-centered approaches to teaching English as a Second Language (ESL) and English as a Foreign Language (EFL) to non-native learners who need to learn English for a very definite academic, professional or vocational purpose.

EDCI 8138. Comparative Language Study. (3) Cross-listed Course(s): ENGL 6166. Rhetorical theories, past and present, focusing on ways that these varied frameworks of understanding have informed the generation, understanding, and pedagogy of writing and other modes of discourse. Emphases vary from semester to semester, readings concentrate on major selected rhetorical theories and on implications of these theories for the understanding and pedagogy of discourse.

EDCI 8139. Perspectives in African American Literature. (3) Cross-listed Course(s): ENGL 6147. A survey of African-American literature, emphasizing the major authors, those relevant historical and social factors, and those specific literary movements that have influenced the development of African-American literature.

EDCI 8140. Current Issues and Practices in Literacy Education. (3) Cross-listed Course(s): READ 6100. Theories, research, and instructional methods associated with reading and language arts, preschool through high school; questions of effectiveness related to instructional approaches and materials; related topics such as multicultural literacy, the role of phonics, and assessment.

EDCI 8152. Varieties of Constructivism in Elementary Education. (3) Examines Piaget's constructivism and various concentrations of constructivism that have arisen in the latter half of the 20th century.

EDCI 8153. Pro-Seminar in Elementary Education. (3) Introduces candidates to elementary education faculty and their research programs to allow doctoral students to connect early in their program with faculty who will chair or serve on their committees. *Graded on a Pass/Unsatisfactory basis.*

EDCI 8154. History of Education in America. (3) In-depth study of the philosophic and historical events influencing the development of the contemporary school. Literature related to trends in curriculum, instruction, social justice, and school configuration will be emphasized.

EDCI 8155. Using Process and Outcome Data to Drive Continuous School Improvement. (3) Prerequisite(s): RSCH 8110. Consideration and study of how successful elementary schools collect and use data to drive their reform activities, with a focus on providing culturally and individually responsive instructional programs.

EDCI 8156. Critical Issues in K-12 Curriculum and Instruction. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction and permission of department. An analysis of historic and current issues related to K-12 curriculum development. Includes opportunities for teacher learning to improve practices in curriculum development, instructional leadership, and classroom management, and an understanding of the influence of socially responsive professional development in urban elementary schools.

EDCI 8157. Analysis of Inquiry in Curriculum, Instruction, and Educator Development. (3) Prerequisite(s): RSCH 8110, RSCH 8111, and RSCH 8210. An analysis of the underlying theoretical and philosophical frameworks of inquiry teaching and learning in K-12 school settings and in educator professional development; examination of current research on models of student and teacher inquiry; and the opportunity to develop a pilot study to investigate effects of inquiry on teaching and learning in K-12 settings or educator development.

EDCI 8158. Research in Curriculum, Instruction, and Educator Development. (3) An analysis of research topics and methodologies in curriculum, instruction, and educator

development. Examination of contemporary research perspectives and paradigms in K-12 education; interpreting and synthesizing the research literature; survey of contemporary research inquiries in curriculum, instruction, and educator development; design and implementation of a pilot research study. *May be repeated for credit up to 6 credit hours.*

EDCI 8160. Readings in Mathematics Education. (3) Readings in the teaching and learning of mathematics K-16; analysis of the historical development of the K-16 mathematics curriculum leading to current trends, issues, and problems; theory, methods, and techniques for assessment; and analysis of contemporary issues.

EDCI 8180. Critical Issues and Perspectives in Urban Education. (3) Introduction to some of the current critical issues in urban education. Topics include: structural inequality, immigration, poverty, (re)segregation, the impact of race, class, ethnicity, gender and language, as well as *No Child Left Behind*. In this course, these topics and other issues will be examined from critical, historical, socio-cultural, and political perspectives. This is an intensive reading and writing course that also requires participation in school and/or community activities to better understand the urban environment.

EDCI 8182. Power, Privilege, and Education. (3) Addresses the critical interconnections of race, class, gender, sexuality and power and privilege in education and beyond. Investigates how these intersections influence individual and group level outcomes. Decodes issues of power and privilege in schools and society, and explores how this awareness can help create an entirely new social landscape.

EDCI 8183. Teaching English as a Second Language. (3) Cross-listed Course(s): TESL 5103. For current and future teachers of English as a Second Language (ESL) to master a variety of approaches, methods, and techniques of teaching ESL and other competencies prescribed by the state of North Carolina.

EDCI 8184. Social Theory and Education. (3) An overview of classical and contemporary developments and debates in social theory, as well as their influences in educational research. It emphasizes the principles and processes of theory development and the application of theory in research. Enhances understanding of theoretical models and analyses and how they form social lens for the examination of school processes.

EDCI 8186. Globalization, Urbanization, and Urban Schools. (3) Explores globalization locally and internationally, with special emphasis on how global development processes are affecting urban communities and urban schools. Explores issues of global governance, global inequality, low-wage economics, and the transnationalization of the globe. It investigates conceptual and theoretical issues underlying globalization, and their impacts on the production of knowledge, educational policy, and school curricula.

EDCI 8201. Perspectives in Immigration and Urban Education. (3) Cross-listed Course(s): EDCI 6201. Examines theories, issues, policies and historical trends in the education of immigrant students in urban public schools. Topics include: theories of immigrant adaptation in relation to race, gender, social class, language learning, and immigration status, demographic trends and their influence on urban schools and on teacher preparation, broader political influences on immigrant education, and the role of family and community in shaping immigrant students' educational trajectories. Students critically analyze scholarly research and theoretical work related to immigration and education in variety of fields.

EDCI 8206. Globalization, Communities, and Schools. (3) Cross-listed Course(s): TESL 6206. Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program. Provides doctoral students a shared space to examine qualitative representations the intersection of globalization and education with specific attention to the experiences of immigrant communities and the contemporary phenomenon of transnationalism. The shared readings, in many cases stemming from dissertations, are intended to serve as potential "mentor" texts as doctoral students realize a research agenda. Moreover, the course ensures an additional layer of certainty that candidates will "establish a respectful environment for a diverse population of students" by embracing diversity in the school community and in the world.

EDCI 8225. Topics and Issues in Middle Grades Education. (3) Cross-listed Course(s): MDLG 6225. Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction and permission of program advisor. Examination of curriculum, instruction, and educational practices in the middle grades (6-9), including research, trends, and issues unique to that philosophy. Emphasis on broadening an understanding of foundational components, organizational patterns, instructional programs, and management techniques.

EDCI 8250. Applied Research in Literacy Education. (3) Cross-listed Course(s): READ 6250. Introduction to the research interests of faculty, with emphasis on research in urban educational issues and problems. Seminar and individual support for replication attempts, instrument development and field-testing in pilot studies, practice in and critique of different methods of data-gathering and data analysis.

EDCI 8252. K-12 Writing Development and Instruction. (3) Cross-listed Course(s): READ 6252. Theories, research, and

critical issues related to students' writing development and effective writing instruction. Field experience required.

EDCI 8254. Collaborative Leadership in Literacy Education. (3) Cross-listed Course(s): READ 6474. Prerequisite(s): Completion of Phase II and READ 6260 course. Investigates models and strategies for assuming the leadership responsibilities of a literacy specialist, including mentoring, staff development, school-wide literacy program development and assessment, supporting the action research of teachers, and developing partnerships with parents and community volunteers.

EDCI 8255. Middle/Secondary Reading and Writing. (3) Cross-listed Course(s): READ 6255. Prerequisite(s): Completion of Phase I. Theories, research, and instructional methods associated with reading and writing in the content areas, with a special emphasis on grades 6-12. Field experience and action research project are required.

EDCI 8256. Diagnostic Assessment and Instruction in Reading. (3) Cross-listed Course(s): READ 6260. Prerequisite(s): Completion of Phase II. Examination, uses, and critique of theories and research about literacy processes and problems; diagnosis and correction of reading disabilities; instructional strategies and action research designed to improve reading proficiency.

EDCI 8260. History and Psychology of Racism. (3) Cross-listed Course(s): ELED 6260. The history and psychology of race and racism is examined, and an analysis of how racism manifests and is sustained by individuals living within systems of power and privilege (micro and macro levels) is explored. An in-depth examination of unconscious racial bias, awareness of privilege, and the impact of ideologies that sustain racism, including colorblind ideology and meritocracy is conducted. Course readings allow students to individually build a knowledge base and develop multiple perspectives. Research methods for the psychology of racism are reviewed as a basis for interpreting research results. Notion of Whiteness as normative in the United States is investigated. How those notions of race and racist beliefs and practices exist in the U.S. (e.g., politics, education, psychological perspectives) are included.

EDCI 8261. Racial Identity Development. (3) Cross-listed Course(s): ELED 6261. Prerequisite(s): EDCI 8260. The examination of: (1) how individuals construct and maintain their sense of themselves as raced beings within historical and ideological constructions of race, and (2) personal- and societal-level consequences of such identities. A review is included of essential theories pertaining to racial and ethnic identity in the U.S. and practical applications related to understanding how racial and ethnic identities play a meaningful role in the human experience and in schools and classrooms.

EDCI 8262. Race in Education and Schooling. (3) Cross-listed Course(s): ELED 6262. Prerequisite(s): EDCI 8260 or EDCI 8261. Analyzes schooling and education from a historical, sociological, political, economic, and contemporary perspective with institutional racism at the center. By examining schooling and education from these perspectives, investigations of urban schools occur to understand how these schools were formed based on white supremacist ideologies. Contributions to the movement of improving schools for students of color is discussed.

EDCI 8263. Anti-Racism Activism in Education. (3) Cross-listed Course(s): ELED 6263. Prerequisite(s): EDCI 8260, EDCI 8261, and EDCI 8262. Examination of the long and inspiring history of anti-racist movements and resistance to racist practices and policies among both people of color and white people throughout American history. The characterizations and impetus for contemporary anti-racist movements, particularly the role of social media as a vehicle for organizing momentum and disseminating information are explored. Analyzes how systems, including education, can organize for lasting social change in effort to create a more equitable and just society.

EDCI 8265. Multiliteracies in a Global World: Reading and Writing Texts in New Times. (3) Cross-listed Course(s): READ 6565. Multiliteracies takes literacy beyond a focus on traditional print-based literacy to multiple-forms of knowing, including print, images, video, and combinations of forms in digital contexts. Students are immersed in both the theory and practice of multiliteracies and considers how globalization has created a more complex environment for teachers and students.

EDCI 8300. Social Stratification and Urban Schools and Communities. (3) Prerequisite(s): EDCI 8184. Investigates social stratification in schools and society. It uses school-society integration framework to explore socially reproducing aspects of the social and economic systems. Through examination of current and past patterns of social organizations and power structures, it produces knowledge about education and mobility opportunities. Emphasizes the socioeconomic implications of school stratification and how this impacts students' life chances.

EDCI 8310. Transformative Black Education. (3) Engages students in an in-depth study of the philosophical, psychological, cultural and historical bases for Black education and the theoretical perspectives underlying a transformative approach to the education of students of African descent in America. The issues covered include the education debt, resilience, psychological effects of racism, education in the Diaspora, African-centered education, culturally nurturing curriculum and pedagogy, and African students in America.

EDCI 8311. Critical Readings in Urban Education Research. (3) Prerequisite(s): RSCH 8111 and RSCH 8121. Furthers students' understanding and practice of Urban Education research studies conducted primarily through qualitative research. The methods presented and the studies covered are of particular importance to anyone conducting qualitative research in urban schools and communities. One critical component of this course is the study of a variety of standpoints and anti-racist methodologies in Urban Education.

EDCI 8312. Urban Schooling, Curriculum, and Pedagogy. (3) At the heart of 'Urban Schooling' are curriculum and pedagogy. Explores the literature on successful teachers, principals, and educational reformers who have developed curriculum and/or pedagogy that have proven effective in urban schools. Critically examines current practices such as managed curriculum and teaching to the test in urban classrooms and proposes education for democracy, that is culturally relevant and emancipatory.

EDCI 8314. Urban Educational Reform. (3) Explores the educational reform movements since 1954, the landmark Brown v. Board of Education Supreme Court case. The major focus is on the current federal legislation, No Child Left Behind, as well as state and local reform as they impact urban schooling.

EDCI 8320. Social Deviance, Delinquency, and Education. (3) Critically examines social deviance and delinquency and their influence on education and beyond. Examines how violence against children is sustained through public policies and social structures and institutions. Explores contemporary forms of deviance, and how they affect student outcomes. Particular consideration is given to the causes of crime, as well as the punishment and treatment of offenders. In addition, special attention is given to deterrence and crime prevention.

EDCI 8330. History of Urbanization and Its Impact on Schooling. (3) Focuses on a historical contextualization of urban developments and their impacts on schools. It examines the American educational system as it relates to politics, economic, cultural practices and public policies. The course explores the shift in the American educational system from rural to urban schools, and it investigates how urbanization shaped schools and created the framework for current issues in urban schools. The course concludes with an analysis of urbanization in Charlotte, North Carolina and how Charlotte schools have been impacted.

EDCI 8420. Writing Program Administration and Supervision. (3) Study of and supervised experiences in the development, administration, supervision, and evaluation of writing programs in urban educational settings. Students may focus on programs at the elementary, middle, or secondary schools or within community and four-year colleges. Emphasis on program development that supports writers from diverse backgrounds.

EDCI 8460. Internship in Urban Education. (3) Prerequisite(s): Permission of instructor. Internship experiences planned and guided cooperatively by University and school personnel.

EDCI 8462. Supervision of Student Teachers. (3) Concentrated practice in the supervision of student teachers with emphasis on support of student teachers in urban schools. Internship experience with direct faculty supervision in seminars and school settings.

EDCI 8475. College Co-Teaching Internship in Curriculum and Instruction. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program. Pre- or Corequisite(s): EDCI 8681. Offers doctoral students an opportunity to gain theoretical and research-based knowledge about college teaching, as well as an opportunity to apply those ideas through a co-teaching internship. Completion of this internship including prerequisites, enables students to co-teach a course as a graduate student or provide coaching to other students if those opportunities become available through the program. *May be repeated for credit up to 9 credit hours.*

EDCI 8485. College Teaching and Educator Development Internship. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program. Pre- or Corequisite(s): EDCI 8681. This internship offers doctoral students an opportunity to apply theoretical and research-based knowledge, skills, and dispositions about college teaching or educator professional development within the context of the Cato College of Education coursework and/or school partnerships. This internship, including prerequisites, enables students to be a co-instructor of a College course as a graduate student with faculty mentoring OR provides the opportunity to coach/supervise/or lead professional development experiences for College of Education teacher candidates or other professional educators if those opportunities become available through the program. *May be repeated for credit up to 9 credit hours.*

EDCI 8609. Curriculum and Instruction Seminar. (3) Cross-listed Course(s): MATH 6609. A series of regularly scheduled meetings in which each student presents one or more topics selected by the instructor.

EDCI 8610. Readings in Mathematics Education. (3) Prerequisite(s): Enrollment in the Mathematics Education specialization of the Doctoral Program in Curriculum and Instruction. Readings in the teaching and learning of mathematics K-16; analysis of the historical development of the K-16 mathematics curriculum leading to current

trends, issues, and problems; theory, methods, and techniques for assessment; and analysis of contemporary issues impacting the teaching of mathematics.

EDCI 8620. Pro-Seminar in Curriculum, Instruction, and Urban Education Leadership. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program. Introduces candidates to professional opportunities for curriculum and instruction, University resources to advance doctoral studies, and education faculty and their research programs. Provides doctoral students opportunities to develop a sense of research, teaching, and service interests and responsibilities of educational professionals in the academe, non-profit and private sectors, district and/or state curriculum and instructional leadership, and urban community outreach and engagement.

EDCI 8640. Readings in Literacy Research. (3) Study of methodology and findings of historical and current research about needs and characteristics of diverse literacy learners in urban-regional environments, successful programs and policies, and promising solutions to educational challenges confronting literacy teachers and literacy learners.

EDCI 8650. Critical Readings in Elementary, Middle Grades, and Secondary Education Research. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction and permission of program advisor. Critical review, analysis, and synthesis of current and historical literature having special significance for elementary, middle grades, and secondary education, with specific focus on research related to educational theory and practice and their implications for teaching and learning in K-12 education.

EDCI 8655. Seminar on Practice-Based Teacher Education and the Science of Learning. (3) Prerequisite(s): Admission to Ph.D. in Curriculum and Instruction program. Offers doctoral students an opportunity to develop theoretical and research-based knowledge on key aspects of emerging trends in teacher education: practice-based teacher education and the science of learning. Seminar activity includes immersive experiences in which students take part in a cycle of instructional practice: including the modeling of teacher practices, use of video exemplars of instruction, rehearsal of practices, and strategies for academic coaching. Also includes a unique "clinical" experience in which students observe knowledgeable instructors in practice-based teacher education and learning science coursework.

EDCI 8660. Readings in Urban Educational Research. (3) Study of methodology and findings of historical and current research about needs and characteristics of urban schools, diverse populations in urban-regional environments, legal and ethical issues, policy-making, and promising solutions to educational challenges of poverty, social justice, language differences, and conflicting values.

EDCI 8681. Seminar in College Teaching. (3) Issues, theories, and research about teaching late adolescent and adult learners. Limited opportunities for supervised teaching experiences with faculty who support students as they teach or co-teach undergraduate courses.

EDCI 8682. Seminar in Professional and Grant Writing. (3) Introduces the forms of professional and grant writing expected of education professionals. Emphasis on writing for publication and writing for federal and state funding. Collaborative writing and peer assessment will be part of the process.

EDCI 8685. Sociocultural Perspectives Language and Literacy. (3) Focuses on sociocultural aspects of literacy and language. Students are immersed in texts and theorists foundational to this line of inquiry and scholarship including the work of Lev Vygotsky, Mikhail Bakhtin, and James Wertsch. The role of culture and social interaction and their influence on language development and learning are explored, as well as its profound implications for teaching, schooling, and education. Students will apply these theories to the analysis of data. The seminar course is an optional selection for students in the Curriculum & Instruction doctoral program.

EDCI 8699. Dissertation Proposal Seminar. (3) Prerequisite(s): Permission of Program Coordinator, Concentration Coordinator, or Advisor. Identification of a research question and development of the proposal for an original research study appropriate for the dissertation requirement. *May be repeated for credit.*

EDCI 8840. Independent Study in Reading, Language, and Literacy. (3) Cross-listed Course(s): READ 6800. Prerequisite(s): Permission of the student's advisor. Independent study of a literacy education problem or issue under the supervision of an appropriate faculty member. *May be repeated for credit.*

EDCI 8850. Independent Study in Curriculum and Educator Development. (3) Prerequisite(s): Permission of the program advisor. Independent study of an elementary, middle grades, secondary, or teacher education problem or issue under the supervision of an appropriate faculty member. *May be repeated for credit.*

EDCI 8860. Independent Study in Mathematics Education. (3) Independent study of a mathematics education problem or issue under the supervision of an appropriate faculty member. *May be repeated for credit up to 12 credit hours.*

EDCI 8880. Independent Study in Urban Education. (1 to 3) Prerequisite(s): Permission of the student's advisor. Independent study of an urban education problem or issue under the supervision of an appropriate faculty member. *May be repeated for credit.*

EDCI 8999. Dissertation Research. (3) Prerequisite(s): Committee approval of the dissertation proposal. Execution of original research study that addresses the solution to an urban educational problem in curriculum, teaching, learning, or leadership. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Education (EDUC)

EDUC 5000. Topics in Education. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

EDUC 5100. Diverse Learners. (3) Strategies for adapting instruction to meet the learning needs of K-12 students, including students at risk for school failure, individuals from culturally and linguistically diverse backgrounds, gifted learners, and special needs populations. Extensive clinical experience required.

EDUC 6000. Topics in Education. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

EDUC 6100. Theories of Human Development and Learning. (3) Concepts of development; philosophical antecedents of developmental and learning theories; role of theory in explaining human nature; components of theoretical explanations; evaluating theories.

EDUC 6101. Culturally Responsive Classroom Management. (2 to 3) Critically addresses school discipline and urban schools. Offers specific approaches and strategies for enacting culturally responsive classroom management (CRCM). Explores how educators can establish an equitable and socially just classroom culture. Particular consideration is given to building mutually respectful relationships with diverse students, engaging parents/guardians/families from different cultural backgrounds, and creating and sustaining a safe, caring, and inclusive classroom using restorative practices that engender a positive learning environment. *May be repeated if a grade of C or below or a U is received.*

EDUC 6102. The Person and School in Urban Society. (3) The basic philosophical theories and sociocultural forces that influence the objectives, structure and programs of schools, agencies and institutions in urban society.

EDUC 6144. Introduction to National Board Certification. (3) Provides a deeper understanding of the National Board for Professional Teaching Standards Certification Process. Emphasis on broadening an understanding of foundational components, including the National Board as a certifying entity, history of the certification process, National Board Standards for each content area, Core Propositions, what every teacher should know and be able to do, learning to be a reflective practitioner, and the steps in the certification process.

EDUC 6150. Principles of Coaching I. (3) The role of coaches and models of coaching are examined. An in-depth exploration of various coaching approaches prepares candidates for planning coaching conversations, leading professional learning communities, and responding to individual teacher needs. Synchronous meetings may be held, as necessary, with individual students to provide additional course support, as indicated through student or instructor request.

EDUC 6151. Coaching for an Equitable Learning Environment. (3) Pre- or Corequisite(s): EDUC 6150. Candidates examine characteristics of an equitable learning environment, how to create and maintain these environments, and how to coach and support other educators' work creating and maintaining these environments. Synchronous meetings may be held, as necessary, with individual students to provide additional course support, as indicated through student or instructor request.

EDUC 6152. Principles of Coaching II. (3) Prerequisite(s): EDUC 6150. Candidates advance teacher leadership development and apply skills and knowledge learned in previous courses in this program, and expand into exploring coaching cycles, frameworks, and critical conversations. Synchronous meetings may be held, as necessary, with individual students to provide additional course support, as indicated through student or instructor request.

EDUC 6153. Application of Coaching Principles. (3) Prerequisite(s): EDUC 6150 and EDUC 6151. Pre- or Corequisite(s): EDUC 6152. Candidates synthesize and apply skills and knowledge learned in previous courses. Candidates facilitate a Professional Learning Community (PLC) where they unpack a literacy or mathematics standard. They also engage in an instructional coaching cycle, and reflect on their experiences. Synchronous meetings may be held, as necessary, with individual students to provide additional course support, as indicated through student or instructor request. Furthermore, students working in schools and, by nature, the program

objectives require that they work with other teachers or teams to engage in the coaching practices applicable to the course. These experiences are necessary to achieve the objectives.

EDUC 6254. Individualizing Instruction for Diverse Learners. (3) Prerequisite(s): Enrollment in M.Ed. in Elementary Education with Concentration in Special Education, M.Ed. in Special Education, or M.Ed. in Reading Education; or permission of instructor. Instructional modifications/adaptations related to meeting the individual learning needs of students. Emphasis on teaming, collaboration, and creating a classroom environment in which all learners can be successful. Differences among learners that are influenced by development, exceptionalities, and diversity are explored using case study methodology.

EDUC 6274. Contexts and Issues in the Teaching of English. (3) Cross-listed Course(s): ENGL 6274. Prerequisite(s): Admission to the M.A. in English with Concentration in English Education or the M.Ed. in Middle/Secondary Education. Examine the key concepts of the discipline. Consider own identities as readers, writers, teachers, researchers, makers of meaning. Emphasis upon critical approaches and pedagogical issues, with special attention to technology in the teaching of language, composition, and literature, as well as cultural contexts for the study of English.

EDUC 6310. Contemporary Issues and Practices of National Board Certification. (3) Corequisite(s): EDUC 6320. An overview of contemporary issues and practices of National Board Certification through the investigation of current research, certification area standards, core propositions, and the process for achieving certification.

EDUC 6320. Planning and Delivering Effective Instruction for National Board Certification. (3) Corequisite(s): EDUC 6310. Prepares students for planning and delivering effective instruction for completion of National Board Certification. An overview of standards, research-based instructional strategies, and assessment techniques are provided.

EDUC 6330. Teaching Practice and Learning Environment for National Board Certification. (3) Prerequisite(s): EDUC 6310 and EDUC 6320. Corequisite(s): EDUC 6340. Prepares students for evaluating and implementing research-based pedagogical practices. Students investigate teaching practice and the learning environment related to National Board Certification. An overview of standards, research-based pedagogical practices, and video analysis are provided.

EDUC 6340. Becoming an Effective and Reflective Practitioner for National Board Certification. (3) Prerequisite(s): EDUC 6310 and EDUC 6320. Corequisite(s): EDUC 6330. Prepares students for evaluating and implementing research-based leadership/learner, community outreach and family/parent outreach opportunities related to National Board Certification. An overview of current research is provided.

EDUC 6651. Piagetian Theory. (3) Prerequisite(s): Permission of the instructor. Advanced seminar for investigation of Piagetian theory with emphasis on genetic epistemology, research and neo-Piagetian concepts.

EDUC 6674. Applied Research Methods in the Teaching of English. (4) Prerequisite(s): EDUC 6274 or ENGL 6274; and 12 credit hours toward the M.A. in English with Concentration in English Education. Building on the research basis established in ENGL 6274/EDUC 6274, this course provides the opportunity to apply research methods in classrooms. Examine identities as readers, writers, teachers, and especially as classroom researchers.

EDUC 6974. Thesis/Project in the Teaching of English. (6) Research integrating the fields of English and Education in a theoretical or application-oriented study. If the thesis/project is the outgrowth of previous coursework rather than a new topic, then considerable additional research and exposition must be done.

EDUC 7126. Comparative Education. (3) Analysis of sociocultural forces affecting educational planning and comparison of contemporary educational systems of selected countries and the United States.

Education: Learning, Design, and Technology (ELDT)

ELDT 5100. Technology Integration in Education. (3) Computer systems and software for enhancing teaching, learning, and educational management; examining issues related to the appropriate selection, integration, and evaluation of technology in educational contexts.

ELDT 6000. Topics in Learning, Design, and Technology. (1 to 6) Variable topics in learning, design, and technology. *May be repeated for credit with change of topic and permission of department.*

ELDT 6100. Foundations of Learning, Design, and Technology. (3) Contemporary issues and historical development of learning, design, and technology. An overview of learning theory, analysis and design of learning environments, instructional design models, technology innovations, and factors affecting the use of technology for learning.

ELDT 6101. Learning Principles in Learning, Design, and Technology. (3) The examination of how people learn in a variety of instructional settings. Characteristics of the different learners are examined. Students investigate several learning theories to inform better instructional design decisions.

ELDT 6102. Research in Learning, Design, and Technology. (3) Introduction to research topics, issues, and trends in learning, design, and technology. Focus on knowledge and skills related to examining research themes in learning, design, and technology, and how theories and methods inform research and practice.

ELDT 6110. Instructional Design. (3) Cross-listed Course(s): ELDT 8110. Instructional analysis, design and evaluation principles and practices; gaining practical experience applying theoretical understandings of instructional design principles and processes such as goal and task analysis, learner and context analysis, instructional strategies, selection and development of instructional materials, and formative and summative evaluation.

ELDT 6120. Current Trends in Learning, Design, and Technology. (3) Examination of current and future trends in learning, design, and technology. Students also examine the most current literature in the field and professional organization trends and recommendations.

ELDT 6121. Advanced Instructional Design. (3) Prerequisite(s): ELDT 6110. Advanced instructional design techniques; students create instructional materials and learning environments using a variety of systems approaches.

ELDT 6130. Instructional Multimedia Development. (3) Cross-listed Course(s): ELDT 8130. Planning, developing, and evaluating instructional multimedia products based on learning principles and research-based best practices.

ELDT 6135. Learning Media, Resources, and Technology. (3) Cross-listed Course(s): ELDT 8135. Selection, use, and evaluation of technological innovations in instructional media. Students learn to make professionally sound decisions in selecting appropriate processes and resources to provide optimal conditions for learning based on principles, theories, and effective practices.

ELDT 6140. Instructional Video Development. (3) Cross-listed Course(s): ELDT 8140. Planning, developing, and evaluating instructional video products based on learning principles and research-based best practices.

ELDT 6150. Design, Development, and Evaluation of Online Learning Systems. (3) Fundamentals of creating effective online teaching and learning systems are covered. Topics include: research-based best practices in the design, development, and evaluation of online instruction, technological applications available to support online teaching and learning, characteristics of virtual students, instructional methodologies for online teaching and learning, and future directions of online teaching and learning research. Differentiated assignments are provided for doctoral students.

ELDT 6160. Designing Learning Systems with Simulation and Game Technology. (3) Educational game and simulation technology learning systems. Students examine principles of game and simulation design, and current research addressing the integration and use of games and simulations in education settings. Emphasis placed on the use of instructional design principles to identify quality characteristics of digital games and simulations, and direct the design and development of these technologies for integration in to instructional content. Differentiated assignments provided for doctoral students.

ELDT 6170. Human Performance Technology. (3) Cross-listed Course(s): ELDT 8170. An introduction to the field of human performance technology. Examines basic concepts and principles of human performance technology, human performance system models, and various approaches to solving human performance problems. In-depth analysis of performance improvement interventions and their implementation within organizations is emphasized.

ELDT 6491. Internship in Learning, Design, and Technology. (3) Application of knowledge and skills in learning, design, and technology so as to create appropriate applications of processes and technologies to improve learning and performance.

ELDT 6492. Capstone Project in Learning, Design, and Technology. (3) Prerequisite(s): ELDT 6100, ELDT 6101, ELDT 6110, ELDT 6130, and ELDT 6491. Continued application of knowledge and skills in learning, design, and technology by development of the capstone project to create appropriate applications of processes and technologies to improve learning and performance.

ELDT 6800. Individual Study in Learning, Design, and Technology. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

ELDT 8000. Topics in Learning, Design, and Technology. (1 to 6) Variable topics in learning, design, and technology. As a doctoral course, emphasis is placed on the theories in learning, design, and technology and how the theories inform research and practice in the field. Differentiated activities and assignments are provided for doctoral

students. *May be repeated for credit with change of topic and permission of department.*

ELDT 8100. Foundations of Learning, Design, and Technology. (3) Contemporary issues and historical development of learning, design, and technology. An overview of learning theory, analysis, and design of learning environments, instructional design models, technology innovations, and factors affecting the use of technology for learning. As a doctoral course, emphasis are placed on the theories in learning, design, and technology and how the theories inform research and practice in the field. Differentiated activities and assignments are provided for doctoral students.

ELDT 8102. Research in Learning, Design, and Technology. (3) Introduction to research topics, issues, and trends in learning, design, and technology. Focus on knowledge and skills related to examining research themes in learning, design, and technology and how theories and methods inform research and practice. Differentiated activities and assignments are provided for doctoral students to include an increased emphasis on dissertation research topics.

ELDT 8110. Instructional Design. (3) Cross-listed Course(s): ELDT 6110. Instructional analysis, design and evaluation principles and practices; gaining practical experience applying theoretical understandings of instructional design principles and processes such as goal and task analysis, learner and context analysis, instructional strategies, selection and development of instructional materials, and formative and summative evaluation. Differentiated assignment on research in instructional multimedia development is provided for doctoral students.

ELDT 8120. Current Trends in Learning, Design, and Technology. (3) The examination of current and future trends in learning, design, and technology. Students also examine the most current literature in the field and professional organization trends and recommendations. As a doctoral course, emphasis is placed on the theories in learning, design, and technology and how the theories inform research and practice in the field. Differentiated activities and assignments are provided for doctoral students.

ELDT 8121. Advanced Instructional Design. (3) Advanced instructional design techniques; systems development; task analysis; sequencing and delivery systems.

ELDT 8130. Instructional Multimedia Development. (3) Cross-listed Course(s): ELDT 6130. Planning, developing, and evaluating instructional multimedia products based on learning principles and research-based best practices. Differentiated assignment on research in instructional multimedia development provided for doctoral students.

ELDT 8135. Learning Media, Resources and Technology. (3) Cross-listed Course(s): ELDT 6135. Selection, use, and evaluation of technological innovations in instructional media. Students learn to make professionally sound decisions in selecting appropriate processes and resources to provide optimal conditions for learning based on principles, theories, and effective practices. Differentiated assignment on research in learning media, resources and technology provided for doctoral students.

ELDT 8140. Instructional Video Development. (3) Cross-listed Course(s): ELDT 6140. Planning, developing, and evaluating instructional video products based on learning principles and research-based best practices. Doctoral students are provided a differentiated assignment to research on video development.

ELDT 8150. Design, Development, and Evaluation of Online Learning Systems. (3) Fundamentals of creating effective online teaching and learning systems will be covered. Topics include: research-based best practices in the design, development, and evaluation of online instruction, technological applications available to support online teaching and learning, characteristics of virtual students, instructional methodologies for online teaching and learning, and future directions of online teaching and learning research. Differentiated assignments are provided for doctoral students.

ELDT 8160. Designing Learning Systems with Simulation and Game Technology. (3) Educational game and simulation technology learning systems. Students examine principles of game and simulation design, and current research addressing the integration and use of games and simulations in education settings. Emphasis is placed on the use of instructional design principles to identify quality characteristics of digital games and simulations, and direct the design and development of these technologies for integration in to instructional content. Differentiated assignments are provided for doctoral students.

ELDT 8170. Human Performance Technology. (3) Cross-listed Course(s): ELDT 6170. An introduction to the field of human performance technology. Examines basic concepts and principles of human performance technology, human performance system models, and various approaches to solving human performance problems. In-depth analysis of performance improvement interventions and their implementation within organizations is emphasized. Differentiated assignment on research in Human Performance Technology provided for doctoral students.

ELDT 8800. Individual Study in Learning, Design, and Technology. (1 to 6) Prerequisite(s): Permission of advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

Elementary Education (ELED)

ELED 5101. Child Development and Instructional Design for Elementary School Learners. (3) Prerequisite(s): Admission to Graduate Certificate in Elementary Education program. Models of child development and learning theories with application for the design of instruction for elementary education learner. *Requires extensive clinical experiences.*

ELED 5110. Developing a Productive and Equitable Learning Environment. (2) Prerequisite(s): Admission to Graduate Certificate in Elementary Education program. Corequisite(s): ELED 5112L and READ 5111. Using models of teaching and issues of child development as basic organizers, major instructional, organizational, management, and assessment approaches within an elementary school setting are introduced. Examination of the models, approaches, and best practices for effective curriculum integration for all students, including children identified with special needs, second language learners, and students performing above or below the general classroom population are conducted throughout the course.

ELED 5112L. Practice-Based Teaching I Lab. (1) Prerequisite(s): Admission to Graduate Certificate in Elementary Education program. Corequisite(s): ELED 5110 and READ 5111. Provides teacher education candidates exposure to the modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making.

ELED 5201. Teaching Mathematics. (3) Basic methodology in teaching mathematics from a constructivist perspective, with examination of other perspectives related to major models of teaching. Examination of the K-6 mathematics curriculum and instructional materials with reference to curriculum integration and to developmental stages of learning and the impact of diversity in mathematics instruction. Emphasis on basic, effective teaching strategies and organizational patterns expected to be used in the schools. Includes attention to prospective teachers' mathematical knowledge. *Requires extensive clinical experiences.*

ELED 5202. Integrating Curriculum for Diverse Elementary School Learners. (3) Prerequisite(s): ELED 5101. Examination of models, approaches, and best practices for effective curriculum integration for all students, including children identified with special needs, second language learners, and students performing above or below the general classroom population.

ELED 5210. Essentials of Teaching Mathematics to Elementary School Learners. (2) Prerequisite(s): ELED 5110, ELED 5112L, and READ 5111. Corequisite(s): ELED 5212L and READ 5211. Basic Methodology in teaching mathematics from a constructivist perspective, with examination of other perspectives related to major models of teaching. Examination of the K-6 mathematics curriculum and instructional materials, with reference to curriculum integration and to developmental stages of learning, and the impact of diversity in mathematics instruction. Emphasis on effective teaching strategies and organizational patterns. Includes an extensive field-based component.

ELED 5212L. Practice-Based Teaching II Lab. (1) Prerequisite(s): ELED 5110, ELED 5112L, READ 5111, and admission to Graduate Certificate in Elementary Education program. Corequisite(s): ELED 5210 and READ 5211. Provides teacher education candidates exposure to the modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making.

ELED 5301. Assessing, Modifying, and Integrating Mathematics Instruction. (3) Application, refinement, and expansion of pedagogical knowledge gained in the first mathematics pedagogy course, with focus upon assessment of student learning, evaluation of effectiveness of instruction, and modification of methods and materials for diverse learners. Closer examination of performance expectations by grade level, EOG testing, and effective instruction for struggling learners. Continued expectation for curriculum integration and use of models of teaching as an organizer for understanding instruction, assessment, and modifications. Applications of technology in mathematics instruction. Design, implementation, and evaluation of math lessons and brief mathematics-centered integrated unit. *Requires extensive clinical experiences.*

ELED 5310. Teaching and Assessment of Mathematics for Elementary School Learners. (2) Prerequisite(s): ELED 5210 ,READ 5211, and ELED 5212L. Corequisite(s): ELED 5312L and READ 5311. Application and refinement/expansion of pedagogical knowledge gained in the introductory mathematics education course with focus upon assessment of student learning, evaluation of effectiveness of instruction, and modification of methods and materials for diverse learners. Closer examination of performance expectations by grade level, EOG Testing, and effective instruction for struggling learners is the focus of this course. Applications of technology and the design, implementation, and evaluation of math lessons and brief mathematics-centered integrated unit are central to mathematics instruction. Includes an extensive field-based component.

ELED 5312L. Practice-Based Teaching III Lab. (1) Prerequisite(s): ELED 5110, ELED 5112L, ELED 5210, ELED 5212L, READ 5111, READ 5211, and admission to Graduate Certificate in Elementary Education program. Corequisite(s): ELED 5310 and READ 5311. Provides teacher education candidates exposure to the modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making.

ELED 5400. Teaching and Integrating Science. (3) Examines the K-6 science curriculum and instructional materials with reference to curriculum integration, developmental stages of learning, and the impact of diversity in science instruction. Emphasis on basic, effective teaching strategies and organizational patterns expected to be used in the schools. Includes attention to prospective teachers' background knowledge as well as teaching competencies in all aspects of the K-6 NC science curriculum. Applications of technology in science instruction. Design, implementation, and evaluation of science lessons and brief science-centered integrated unit. Evaluation of student learning and strategies for instructional modifications for diverse learners. *Requires extensive clinical experiences.*

ELED 5401. Teaching and Integrating Social Studies. (3) Examines the K-6 social studies curriculum and instructional materials with reference to curriculum integration and to developmental stages of learning and the impact of diversity in social studies instruction. Emphasis on basic, effective teaching strategies and organizational patterns expected to be used in the schools. Includes attention to prospective teachers' background knowledge as well as teaching competencies in all aspects of the K-6 NC social studies curriculum. Applications of technology in social studies instruction. Design, implementation, and evaluation of social studies lessons and brief social studies-focused integrated unit. Evaluation of student learning and strategies for instructional modifications for diverse learners. *Requires extensive clinical experiences.*

ELED 6000. Topics in Elementary Education. (1 to 6) May include classroom and/or clinic experiences in the content area. *May be repeated for credit with permission of department.*

ELED 6101. Applications of Theories of Human Development and Learning. (3) Review of paradigms of human development theory as a basis for identifying and clarifying teachers' beliefs about development and learning. Analysis and subsequent improvement of alignment of teachers' instructional practices to their chosen theoretical paradigms.

ELED 6111. Critical Issues in Elementary Education. (3) Three categories of instructor-and student-selected issues: government, governance, and the elementary schools; changing educational roles of professional educators, parents, and children; and the evolving missions of elementary schools. Focus on the self as learner and the re-examination of one's beliefs, teaching practices, and learning in multiple contexts.

ELED 6200. Current Issues in Global and Urban Elementary Schools. (3) Prerequisite(s): Admission to M.Ed. in Elementary Education program. Candidates demonstrate an understanding of global, civic, and urban issues that impact local teaching and learning ideals. The course is reading and writing intensive, as candidates are required to reflect on and analyze instruction for diverse learners using a variety of flexible and adaptable instructional methods appropriate for learning in a globalized educational context.

ELED 6201. Theories of Human Development and Learning in Cultural Contexts. (3) Prerequisite(s): Admission to M.Ed. in Elementary Education program. Requires candidates to critically analyze child, adolescent, and cognitive development to determine developmental needs in an effort to design relevant yet rigorous instruction. Candidates are also required to critically examine paradigms and theories of development, conceptual relationships between education and developmental paradigms, the concepts of learning and development, and the roles and responsibilities of school staff for meeting children's developmental and cultural needs.

ELED 6202. Creating Equitable Elementary Classroom Environments. (3) Prerequisite(s): Completion of Graduate Certificate in Teaching: Elementary Education; admission to the M.A.T or M.Ed. in Elementary Education program; and employment as an elementary teacher. Examination of theory, models, and best practices in classroom management, with focus on management of special populations of students. Emphasis on demonstrating best practices of classroom management models of instruction through professional development leadership.

ELED 6203. Instructional Differentiation and Leadership for 21st Century Learners. (3) Prerequisite(s): Admission to the M.A.T or M.Ed. in Elementary Education program; and employment as an elementary teacher. Examination of models, approaches, and best practices for effective instructional differentiation for diverse learning needs of elementary school students.

ELED 6210. Current Issues in STEM Education. (3) Examination of current issues related to Science, Technology, Engineering, and Mathematics (STEM) Education. Requires approximately 8-9 hours each week. Out-of-class work may include, but is not limited to: required reading, critical analysis of literature, research

papers, and projects related to STEM issues related to elementary school learners.

ELED 6211. Integrating Engineering into the Elementary School Curriculum. (3) An analysis of engineering concepts related to the science standards taught in Grades K-6 in North Carolina Public Schools. The Engineering is Elementary curriculum and other related resources is examined in depth. Analysis of how science, technology, and mathematics can be integrated with engineering is emphasized.

ELED 6212. Integrating Digital Learning and STEM with Elementary School Learners. (3) Examination of digital learning (e.g., web-based tools, digital videos) to support the teaching of STEM education. Students analyze a real-world problem, analyze digital learning tools, plan and implement a lesson around the real-world problem using digital learning tools.

ELED 6213. Global Awareness in STEM Education. (3) Examination of global awareness, humanities, and the environment in the context of STEM Education. Students research, reflect on, and apply knowledge related to Earth and the environment in relationship to issues and trends related to STEM.

ELED 6214. Designing and Developing STEM Curricula. (3) Analysis of critical components of designing, developing, and implementing a multi-lesson unit related to a real-world issue in STEM education. Students design, teach, and assess the impact of STEM curricula that they develop. Students also design professional development around the curricula they develop.

ELED 6221. Teaching and Learning K-6 Science. (3) Prerequisite(s): Completion of Phase One. Critical reading and use of the literature in science education, examination of science content taught in the elementary school, multiple models and approaches for teaching and assessing learning in science, required action research project.

ELED 6241. Teaching and Learning K-6 Social Studies. (3) Prerequisite(s): Completion of Phase One. Critical reading and use of the literature in social studies education, examination of social studies content taught in the elementary school, multiple models and approaches for teaching and assessing learning in social studies, required action research project.

ELED 6251. Teaching and Learning Mathematics. (3) Prerequisite(s): Core requirements. Examination of the K-6 mathematics curriculum, including a critical analysis of research literature related to problem solving processes and mathematics learning.

ELED 6252. Teaching and Learning K-6 Mathematics. (3) Prerequisite(s): Completion of Phase One. Critical reading and use of the literature in mathematics education, examination of mathematics content taught in the elementary school, multiple models and approaches for teaching and assessing learning in mathematics, required action research project.

ELED 6255. Math CAMMP. (3) CAMMP stands for Computer Applications and Manipulative Mathematics Program. Examination of constructivism in K-8 mathematics teaching, with emphasis on concrete, representational, and symbolic manipulatives; developmentally appropriate computer software; developmentally appropriate instructional tactics; and preparing a thematic instructional module. The course culminates in a week long practicum with elementary students.

ELED 6260. History and Psychology of Racism. (3) Cross-listed Course(s): EDCI 8260. The history and psychology of race and racism is examined, and an analysis of how racism manifests and is sustained by individuals living within systems of power and privilege (micro and macro levels) is explored. An in-depth examination of unconscious racial bias, awareness of privilege, and the impact of ideologies that sustain racism, including colorblind ideology and meritocracy is conducted. Course readings allow students to individually build a knowledge base and develop multiple perspectives. Research methods for the psychology of racism are reviewed as a basis for interpreting research results. Notion of Whiteness as normative in the United States is investigated. How those notions of race and racist beliefs and practices exist in the U.S. (e.g., politics, education, psychological perspectives) are included. Students consider various approaches to race/racism that ground race in biology, heredity, genetics, culture, or social identity.

ELED 6261. Racial Identity. (3) Cross-listed Course(s): EDCI 8260. The examination of (a) how individuals construct and maintain their sense of themselves as raced beings within historical and ideological constructions of race, and (b) personal- and societal-level consequences of such identities. A review is included of essential theories pertaining to racial and ethnic identity in the U.S. and practical applications related to understanding how racial and ethnic identities play a meaningful role in the human experience and in schools and classrooms.

ELED 6262. Race in Education and Schooling. (3) Cross-listed Course(s): EDCI 8262. Analyzes schooling and education from a historical, sociological, political, economic, and contemporary perspective with institutional racism at the center. By examining schooling and education from these perspectives, investigations of urban schools occur to understand how these schools were

formed based on White supremacist ideologies. Contributions to the movement of improving schools for students of color is discussed.

ELED 6263. Anti-Racist Activism in Education. (3) Cross-listed Course(s): EDCI 8263. Prerequisite(s): ELED 6260, ELED 6261, and ELED 6262. Examination of the long and inspiring history of anti-racist movements and resistance to racist practices and policies among both people of color and white people throughout American history. The characterizations and impetus for contemporary anti-racist movements, particularly the role of social media as a vehicle for organizing momentum and disseminating information are explored. Analyzes how systems, including education, can organize for lasting social change in effort to create a more equitable and just society.

ELED 6303. Teacher Inquiry and Data Analysis in the Elementary Classroom. (3) Prerequisite(s): Admission to the M.A.T or M.Ed. in Elementary Education program; and employment as an elementary teacher. This is the capstone experience in the M.A.T. and M.Ed. programs and, thus, must be taken in the final semester of the program. The examination of data-driven instructional decision making and the use of research to improve student learning. Requires application of advanced content knowledge, instructional planning, and student assessment data in the creation of a capstone experience.

ELED 6311. Number Systems and Operations: K-5 Mathematical Tasks. (3) Prerequisite(s): Admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Analysis and construction of effective mathematical tasks in teaching number systems and operations at the K-5 level. Attention is also given to the expansion of content knowledge.

ELED 6312. Geometry and Spatial Visualization: K-5 Assessment. (3) Prerequisite(s): ELED 6311 and admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Formative and summative assessment strategies of students' geometric thinking in elementary grades; concept development of 2- and 3-dimensional geometry. Attention also given to diagnosis of student errors.

ELED 6313. Algebraic Reasoning: K-5 Discourse and Questioning. (3) Prerequisite(s): ELED 6311 and admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Focus on the early algebra concepts of functional thinking and generalized arithmetic in relationship to pedagogical practices centered on questioning in the mathematics classroom.

ELED 6314. Rational Numbers and Operations: K-5 Learning Trajectories. (3) Prerequisite(s): ELED 6311 and admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Focus on rational number concepts through learning trajectories at the K-5 level. Attention also given to problem solving and content knowledge.

ELED 6315. Data Analysis and Measurement: K-5 Classroom Interactions. (3) Prerequisite(s): ELED 6311 and admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Focus on statistical literacy of elementary teachers and the teaching of data analysis and measurement to K-5 students. Attention is also given to learning methods which facilitate appropriate classroom interactions.

ELED 6316. Mathematical Modeling: K-5 Leadership. (3) Prerequisite(s): ELED 6311, 6312, 6313, 6314, and 6315; and admission to the Elementary School Mathematics Add-on Licensure or M.Ed. in Elementary Education program. Generating mathematical representations and making explicit connections between concepts. Pedagogy designed to equip elementary teachers to become mathematics teacher-leaders in school settings. Focus given to topics integrated within mathematical strands.

ELED 6470. Graduate Student Teaching/Internship in Elementary Education. (6) Prerequisite(s): Completion of all program coursework required for eligibility to student teach, an application for the course by the established deadline, and approval of the department. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

ELED 6800. Individual Study in Elementary Education. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

Engineering Management (EMGT)

EMGT 5090. Special Topics. (1 to 6) Directed study of current topics of special interest. *May be repeated for credit.*

EMGT 5114. Production Control Systems. (2) Cross-listed Course(s): SEGR 4114. Pre- or Corequisite(s): EMGT 5202 or permission of department. Principles, analysis, and

design of production and inventory planning and control systems. Demand forecasting, production scheduling and control systems, and introduction to supply chain management.

EMGT 5141. Engineering Experimental Design. (3) Cross-listed Course(s): SEGR 4141. Pre- or Corequisite(s): EMGT 5202 or permission of department. Focuses on how to achieve high-quality/low-cost systems based on Taguchi methods, design of experiments methods, and statistical analysis of data. Also includes an introduction to response surface methods.

EMGT 5142. Reliability Management and Survival Analysis. (3) Cross-listed Course(s): SEGR 4142. Pre- or Corequisite(s): EMGT 5202 or permission of department. Introduces various reliability and survival analysis techniques. Topics include: reliability/survival functions, failure/hazard rate functions, reliability testing for single and multivariate distributions, parametric/non-parametric/semi-parametric techniques.

EMGT 5150. Leadership Skills for Engineers. (3) Prerequisite(s): Junior standing. Overview of the skills needed to practice the most popular leadership styles in industry today. The first half of the course covers an introduction to the different styles of leadership and how they are applied by Engineers within an organization. The second half of the course covers the critical leadership skills and competencies needed to build and lead powerful teams in a global environment.

EMGT 5154. Bayesian Analysis for Human Decision. (3) Cross-listed Course(s): SEGR 4154. Pre- or Corequisite(s): EMGT 5202 and EMGT 5203, or permission of department. The Bayesian approach to decision-making with numerous applications in engineering, business, and healthcare. Discriminant analysis and ROC curve. Expected value maximization, decision trees, Bayes' theorem, value of information, Bayesian networks and optimal strategies. Axiomatic utility controversies and prospect theory. Theoretical and empirical determination of utility functions and relationship to human belief network. Brief introduction to multi-attribute problems, time streams, data envelopment analysis, and group decisions.

EMGT 5170. Total Quality Systems. (3) Cross-listed Course(s): SEGR 4170. Pre- or Corequisite(s): EMGT 5202 or permission of department. Explores statistical process control techniques, including various types of control charts and process capability assessment. Additional product design and development methods such as Quality Function Deployment and Design of Experiments are also discussed.

EMGT 5201. Fundamentals of Deterministic System Analysis. (3) Cross-listed Course(s): SEGR 4201. The fundamentals of deterministic system analysis. The course is partitioned into three modules: (1) linear algebra and matrix analysis, (2) continuous optimization for linear and nonlinear systems, and (3) discrete optimization by integer programming and dynamic programming.

EMGT 5202. Fundamentals of Stochastic System Analysis. (3) Cross-listed Course(s): SEGR 4202. Pre- or Corequisite(s): EMGT 5201. The fundamentals of stochastic system analysis. The course is dissected into three modules: (1) probability and statistics, (2) stochastic models, and (3) regression analysis.

EMGT 5203. Fundamentals of Engineering Management. (3) Cross-listed Course(s): SEGR 4203. Pre- or Corequisite(s): EMGT 5201. The fundamentals of engineering management. The course is dissected into three modules: (1) engineering economics, (2) decision and Bayesian analysis, and (3) game theory.

EMGT 5961. Introduction to Energy Systems. (3) Prerequisite(s): Junior standing, Basic math, economics, or consent of instructor. Overview of energy systems: energy types, generation, conversion, storage, transportation/transmission, and utilization. Principles, physical structure, processes, and utilization of fossil fuel, nuclear, and renewables for transportation, thermal, and electrical energy generation are discussed along with associated performance metrics. Also provides an introduction to environmental impacts of energy production, life-cycle analysis, energy efficiency concepts and metrics, transmission systems, grid reliability, and the impact of smart grid technologies. All topics are presented in the context of industry standards as well as federal and state regulations.

EMGT 5962. Energy Markets. (3) Cross-listed Course(s): MBAD 6962. Prerequisite(s): Basic math and economics, or permission of instructor. Energy and power systems in regulated and competitive environments and implications on business decisions for firms in these industries. Topics include: mechanism of energy markets; comparative market systems; determination of prices under different market structures; gas, oil, coal, and electricity market architecture; electricity market design; dispatch and new build decisions; smart grid and renewable energy in electricity markets; risk and risk management in energy including demand and price volatility and use of financial derivatives; and the impact of financial market trends and current and proposed policies on the energy industry.

EMGT 5963. Energy Systems Planning. (3) Prerequisite(s): Basic math and economics, or permission of instructor. Optimal planning of resources, logistics, distribution and storage in the end to end energy value chain from

upstream natural gas production through mid-stream transportation and storage to downstream power generation, utility distribution and consumption. Smart Grid Optimization. Supplier and customer relationship management, contracts management. Lean-Six Sigma energy system process design. Power systems reliability and control, preventive maintenance, predictive maintenance, process and service quality control.

EMGT 5964. Case Studies in the Energy Industry. (3) Prerequisite(s): Basic math and economics, or permission of instructor. Introduce students to interpret and analyze real world business cases in the energy sector. Cases explore the concepts behind natural monopolies, utility ownership, regulation and de-regulation, utility rates and service standards. Additionally, economic concepts such as supply and demand, market pricing, producer surplus, monopolistic pricing, and ratemaking (regulatory goals, revenue requirements and the rate base and rate cases) are applied. Some cases explore decision-making strategies surrounding marginal prices, congestion management, congestion revenue, electric and gas transmission rights both in terms of physical versus financial markets, locational marginal prices (LMP), financial transmission rights in terms of revenue adequacy and auction revenue rights and typical energy trading hedging practices.

EMGT 6090. Special Topics. (1 to 6) Directed study of current topics of special interest. *May be repeated for credit.*

EMGT 6112. Introduction to Dynamic Programming and Optimal Control. (3) Prerequisite(s): EMGT 5202. Introduces optimization over time for dynamic systems. Topics include: deterministic systems, perfect and imperfect state information, finite and infinite horizon problems, and deterministic optimal control.

EMGT 6113. Cluster Analysis and Applications. (3) Cross-listed Course(s): INES 8090. Prerequisite(s): EMGT 5201 or permission of instructor. Cluster analysis is a fundamental data analysis task applicable to many fields. Iintroduces several important clustering algorithms and their applications in marketing, forecasting, ranking, pattern recognition, etc.

EMGT 6116. System Identification and Reinforcement Learning. (3) Prerequisite(s): EMGT 5202 or permission of instructor. In-depth exploration of behavioral applications to optimal control and reinforcement learning theory. Topics include: reinforcement learning/neuro-dynamic programming and applications using flying drones and virtual reality machines.

EMGT 6142. Quality and Manufacturing Management. (3) Provides an in-depth study of current issues and advances in manufacturing management. Topics include: just-in-time inventory management, total quality management, statistical process control, continuous improvement, flexible manufacturing systems, computer-integrated manufacturing, technology evaluation and selection, and manufacturing strategy. Emphasis on use of computers for decision support.

EMGT 6890. Individual Study. (1 to 6) Individual investigation and exposition of results. *May be repeated for credit.*

EMGT 6901. Advanced Project Management. (3) Prerequisite(s): Permission of Instructor. Study of various aspects of project management including project types and organizations, regulatory and liability issues, planning, budget, risk assessment, and conflict resolution. Exercises involve research into emerging management processes, use of computerized techniques, and application of management theories in team-based projects.

EMGT 6902. Legal Issues in Engineering Management. (3) Survey of legal issues surrounding engineering products and services, including warranty, liability, contracting, intellectual property, codes, and accepted practice. Legal principles, precedents, case studies, and research projects.

EMGT 6904. Product and Process Design. (3) Application of principles of creative problem solving to design of products and processes by multi-disciplinary teams. Taking as the definition of design "the communication of a set of rational decisions for accomplishing stated objectives within prescribed constraints," the teams produce elements of designs for various products and services at points in the sequential stages of design. Teams make periodic reports and presentations to the class on design assignments.

EMGT 6905. Designed Experimentation. (3) Prerequisite(s): Statistics and permission of instructor. Design of quality into products and processes using statistically designed experimentation (DOE), a systematic and efficient method of design optimization for enhanced performance, quality, and cost. Emphasis on designing and conducting useful experiments rather than the basis in statistical theory. Includes robust parameter design and tolerance design techniques. Review and comparison of Taguchi methods with conventionally designed experimentation. Extensive use of specialized computer software to design experiments and analyze results in team projects; screening experiments, and sequential response surface methods.

EMGT 6906. Processing Systems Simulation. (3) Prerequisite(s): Statistics. Principles and application of selecting, planning, and executing simulation projects for processing systems, and developing and experimenting

with simulation models. Discrete event simulation is particularly powerful for modeling and experimenting with systems exhibiting interdependencies and variability - such as manufacturing and service systems. Students learn simulation project management, modeling, and experimenting using commercial simulation software products.

EMGT 6910. Forecasting Techniques, Methodologies, and Practice. (3) Cross-listed Course(s): INES 8090. Prerequisite(s): EMGT 5202 or permission of instructor. A comprehensive introduction to forecasting techniques and methodologies that offers practical guidance to apply them in the real-world decision-making processes. The techniques may include, but are not limited to: time series analysis, regression analysis, artificial neural networks, and other machine learning techniques. The methodologies may include, but are not limited to: forecast combination, hierarchical forecasting, probabilistic forecasting, judgmental forecasting, and technological forecasting. The applications may include, but are not limited to: energy forecasting, retail forecasting, healthcare forecasting, tourism forecasting, sports forecasting, and new product forecasting.

EMGT 6912. Computational Intelligence. (3) Cross-listed Course(s): INES 8090. Prerequisite(s): EMGT 5201 or permission of instructor. Computational intelligence, a.k.a. soft computing, is the use of inexact solutions to computationally hard tasks such as the solution of NP-complete problems. This course provides a comprehensive introduction to computational intelligence techniques and their applications in solving optimization problems and complex real-world problems. The techniques may include, but are not limited to: fuzzy logic and fuzzy systems, neural networks and deep neural networks, support vector machines, genetic algorithms, metaheuristics and swarm intelligence, and Bayesian network.

EMGT 6915. Engineering Decision and Risk Analysis. (3) Prerequisite(s): Integral and Differential Calculus, Statistics, Probability, or permission of instructor. Useful tools for analyzing difficult decisions and making the right choice. After introducing components and challenges of decision making, the course proceeds with the discussion of structuring decisions using decision trees and influence diagrams. Decision making under uncertainty is emphasized including maximax, maximin, and minimax regret techniques. Modeling of different risk attitudes based on risk and return tradeoffs are analyzed through utility theory. Finally, decisions under conflicting objectives and multiple criteria are discussed along with some introduction to game theory.

EMGT 6920. Logistics Engineering and Management. (3) Prerequisite(s): Permission of instructor. Introduces logistics systems from a systems engineering perspective. It starts from the design of effective and efficient systems with their respective maintenance and support infrastructures to the coordination of the production and distribution of systems and products for customer use at different stages of a final product's life cycle. The emphasis is on the design and implementation of effective and efficient logistics systems and supply chains. Contents also include the current management issues in logistics systems implementation and supply chain operations.

EMGT 6924. Lean Six Sigma Practice and Management. (3) Provides an understanding of the Lean Six Sigma system design principles and tools. Discusses the lean continuous improvement cycle: 1) defining value using tools such Quality Function Deployment; 2). proceeding with identifying value streams using Value Stream Mapping; 3) making the value stream flow though the elimination of 7 wastes, line balancing, 5S, cellular layouts, SMED; 4) pulling resources JIT based on demand; and 5) achieving perfection through Kaizen events and statistical process control. Six Sigma improvement cycles DMAIC (Define, Measure, Analyze, Measure and Control) and DMADV (Define, Measure, Analyze, Design and Verify) are also discussed and synergies with lean principles are reviewed to create a Lean Six Sixma system. Students are exposed to industry cases from major companies that illustrate the challenges and best practices of implementing a Lean Six Sigma system.

EMGT 6926. Lean Supply Networks. (3) Builds fundamental lean systems skills to effectively design, plan, and execute lean supply networks that deliver value to customers. With the ongoing global pressure of cost cutting and quality focus, many companies have been implementing "lean manufacturing" concepts to survive in this competitive marketplace. While this is a good start, lean concepts need to be implemented beyond the four walls of a company across its supply chain. Lean principles do not only apply to manufacturing but to service organizations as well. This course helps students understand the principles of lean, supply chain management, and provide you with the related tools and techniques to make supply chains and companies deliver goods and services successfully. Students are exposed to industry cases from major companies that illustrate the challenges of managing lean supply networks.

EMGT 6930. Capital Cost Estimating. (3) Prerequisite(s): Permission of instructor. Provides in-depth study of cost management issues in a technological business environment. It covers cost concepts including project evaluation techniques based on cost, capital planning and budgeting, investment evaluation under risk and uncertainty, rate of return methods, estimating for economic analyses, inflation effects, depreciation and income taxes, and capital investment decision analysis.

Private and public sector cost issues are also discussed. The tools and techniques presented are useful for engineering, business, or management professionals of any organization. Students learn how to use the course material for effective project management, budgeting, and decision making.

EMGT 6950. Engineering Systems Integration. (3) Prerequisite(s): Permission of instructor. An introduction to the relevant issues and required techniques for successful systems design development, integration, management, and implementation. Principles and methods for system life-cycle analysis, system planning and management, and systems integration. Interfaces between the system, subsystems, the environment, and people. Students learn the factors to control the total system development process designed to ensure a high quality and effective system.

EMGT 6952. Engineering Systems Optimization. (3) Cross-listed Course(s): INES 8090. Prerequisite(s): Calculus and Linear Algebra or permission of instructor. Develops fundamental problem-solving skills for engineers and engineering managers using techniques for optimizing engineering systems, with focuses on nonlinear optimization. Convex analysis, optimality conditions, unconstrained optimization, and constrained optimization are emphasized.

EMGT 6955. Systems Reliability Engineering. (3) Prerequisite(s): Calculus and Statistics. Introduction of concepts and methods for the design, testing and estimation of component and system reliabilities. Topics include: reliability mathematics; analysis of reliability data; reliability prediction and modeling; reliability testing: maintainability and availability; failure mode and effects analysis and failure rates; reliability design and implementation; application of concurrent engineering and reliability methods to integrate reliability tests into the overall system development cycle to reduce overall life cycle costs.

EMGT 6965. Energy Analytics. (3) Prerequisite(s): EMGT 5202 or permission of instructor. Energy analytics is an interdisciplinary area applying techniques and methodologies of engineering management, economics, statistics and electrical engineering to solve real-world analytical problems in the energy industry. Designed for current and future analysts, operators, planners and their managers in the energy industry. Covers major energy-related applications of descriptive, predictive and prescriptive analytics. Topics include: energy data analysis, load forecasting, price forecasting, renewable generation forecasting, energy trading and risk management, demand response and customer analytics, and utilities outage analytics.

EMGT 6980. Industrial and Technology Management Seminars. (1) Prerequisite(s): Permission of instructor. A series of seminars covering current management issues, challenges and practices in industrial, government, and business sectors of industry. *May be repeated for credit.* (All students in the M.S. in Engineering Management program are required to take this course within the first or second semester of the program.)

EMGT 6985. Engineering Management Project. (3) Prerequisite(s): EMGT 6980 and two other program required EMGT courses. A data-driven, real world industrial/business project. Emphasizes the design and implementation of effective methods on the development and/or improvement of products, processes, procedures, or systems. A 3-member project committee which includes at least two faculty members from the Department of Systems Engineering and Engineering Management has to be established before taking this project course. This project is a capstone project for the students in the M.S. in Engineering Management program.

EMGT 6990. Industrial Internship. (1 to 3) Prerequisite(s): Completion of 9 credit hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director. Requires a mid-term report and final report to be submitted.

EMGT 6991. Graduate Master Thesis Research. (1 to 6) Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

Energy and Electromechanical Systems (ENER)

ENER 5000. Special Topics. (1 to 4) Cross-listed Course(s): ENER 4000. Examination of specific new areas which are emerging in the various fields of engineering technology and/or construction management. Builds upon the knowledge the students have gained from their engineering technology and/or construction management curriculum. *May be repeated for credit.*

ENER 5123. Active Filters. (3) Cross-listed Course(s): ELET 4123. The design, analysis, simulation, and implementation of composite, cascaded and summation filters. Topics include: bilinear transfer functions; cascade design with first-order circuits; biquad circuits; Butterworth lowpass circuits; Butterworth bandpass circuits; the Chebyshev

response; sensitivity; frequency transformations; highpass and band-elimination filters .

ENER 5152. Digital Signal Processing. (3) Cross-listed Course(s): ELET 4152. Discrete-time signals; discrete-time systems; Linear constant-coefficient difference equations; Periodic sampling; reconstruction from samples; changing the sampling rate; the z-transform; z-transform properties; transform analysis of linear time-invariant systems; digital filter design techniques; discrete Fourier Transform and the FFT algorithm.

ENER 5140. Energy Management. (3) Study of the understanding and implementation of energy management techniques. Emphasis is on energy efficiency applications in homes, businesses, large buildings and industry. Topics include: energy auditing, energy management, energy cost analysis, energy and electric rate structures, lighting, HVAC systems, motors and drivers, boilers and steam systems, cogeneration, commercial and industrial applications, and alternative energy sources.

ENER 5196. Introduction to Robotics. (3) Cross-listed Course(s): ECGR 5196. Introduction to the broad field of robotics, including industrial assembly robots, autonomous vehicles, and entertainment robots. Emphasis on the basic technologies and integration of mechanical, electrical, and software sub-systems into a complete device.

ENER 5250. Analysis of Renewable Energy Systems. (3) System analysis of renewable energy systems: well-to-wheels analysis, lifecycle energy and emissions, total cost, skill sets, methodologies and tool kits needed to analyze various technologies on a consistent basis for a given application. Topics include: solar photovoltaics, wind energy, and fuel cell technologies.

ENER 5260. Hydrogen Production and Storage. (3) Basic concepts and principles of hydrogen technologies, including properties, usage, safety, fundamental understanding of hydrogen storage and production technologies.

ENER 5274. Applied Computational Methods. (3) Introduction to computational method concepts, uses, and limitations to support the selection of techniques for specific engineering applications. Lays a foundation for students to engage in further study and/or research projects that involve numerical methods. Numerical methods pertain to a branch of mathematics that solves continuous problems using numeric approximation. It involves designing algorithms that give approximate but accurate numeric solutions, which is useful in cases where the exact solution is impossible or prohibitively expensive to calculate. Students use standard engineering applications (e.g., MATLAB) to implement the computational methods covered in this course; prior experience with a specific software application is not required.

ENER 5275. Air Conditioning Systems. (3) Functions and operating characteristics of the major components of refrigerating machines, heat pumps, boilers, furnaces, solar collectors, heat exchangers, fans and pumps. Emphasis on sizing, economics and performance characteristics. Includes coverage of psychometric principles and fan and pump laws.

ENER 5280. Fuel Cell Technology. (3) Basic concepts and principles of fuel cell technologies, including chemistry, thermodynamics, electrochemistry, cell components and operating conditions fuel cell systems.

ENER 5285. Applied Noise and Vibration Control. (3) Laplace transformation method for solution of differential equations. Review of Newton's 2nd Law of Motion. Solution to the free vibration problem both with and without damping. Introduction to acoustics and the one dimensional solution to the wave equation. Noise sources and mechanics of noise generation. System design for noise and vibration minimization. Methods of noise and vibration remediation.

ENER 5290. Advanced Instrumentation. (3) Cross-listed Course(s): ENER 4290. Methodologies for measurement, analysis, and control of physical components of conventional and renewable energy conversion and storage systems.

ENER 6000. Special Topics in Applied Energy or Electromechanical Systems. (1 to 3) Study of specific new areas emerging in the various fields of energy and electromechanical systems. *May be repeated for credit.*

ENER 6120. Energy Generation and Conversion. (3) Overview of energy use. Fossil fuel resources and energy conversion. Solar energy principles, solar collector, photovoltaic cells and applications. Wind energy and wind turbines. Nuclear energy principles, nuclear reactors and power generation. Geothermal and Hydraulic energy conversion. Hydrogen energy, storage, and transportation. Overview of fuel cell, fuel cell types, and application.

ENER 6135. Energy Transmission and Distribution. (3) Power transmission and distribution network architectures. Transmission line models, parameters, and equivalent circuits. Symmetrical components. Power flow studies. Symmetrical and unsymmetrical faults. Transient operation and power system protection. Power system stability. Distribution optimization.

ENER 6150. System Dynamics. (3) Energy-based modeling of dynamic mechanical, electrical, thermal, and fluid systems to formulate linear state equations, including system stability, time domain response, and frequency domain techniques.

ENER 6170. Applied Mechatronics. (3) Analog electronic design for purposes of controlling electromechanical systems, including electromechanical sensors and actuators, analog electronic design of filters, state-space and classical controllers, and transistor-based servoamplifiers and high voltage amplifiers. Significant laboratory component with design and fabrication of circuits to control electromechanical systems. Implementation of digital controllers.

ENER 6220. High Voltage Technology. (3) Covers concepts of high voltage generation, measurements, protection and safety. Study of high electric fields theory, breakdown mechanisms in gases, liquids, and solid dielectrics. The high voltage insulation, including insulation coordination, is also discussed. Instruction on high voltage applications and safety.

ENER 6235. Modern Electric Power Grids. (3) Instruction on network steady-state analysis; faults; protection systems; switching equipment; voltage and power static control; surge voltages and protection, transient operation and stability, "smart grid" enabling technologies.

ENER 6260. Computational Fluid Dynamics for Energy Applications. (3) Introduction to the use of commercial CFD codes to analyze flow and heat transfer in energy related problems. Finite difference and finite volume methods, SIMPLE model for incompressible flow, models of simple geometries are developed and studied, post processing and visualization. Overview of turbulence and turbulence modeling.

ENER 6270. Dynamic Systems Control and Design. (3) Analysis and design of dynamic systems control. Analysis of linear feedback systems, deterministic and stochastic dynamic systems, their characteristics, robust stability, and robust performance. Robust control, Kalman filter, and its design and compensation of deterministic and stochastic dynamic systems, including wind turbines system control and piezo (mechatronics) systems.

ENER 6800: Independent Study. (1 to 3) Prerequisite(s): Permission of graduate committee advisor. Individual investigation and exposition of results for a directed project in energy and electromechanical systems. *May be repeated for credit.*

ENER 6850. Capstone Project. (3) Prerequisite(s): Completion of at least 9 credit hours in the Applied Energy and Electromechanical Systems program. Individual investigation in the form of a project in the areas of Applied Energy and/or Electromechanical Systems culminating in an exposition of results in the form of a formal presentation to faculty and a professional conference-formatted paper. The proposed project must be pre-approved by a mentoring member of the program faculty and the Graduate Program Director.

ENER 6900: Master's Research and Thesis. (1 to 6) Prerequisite(s): Permission of Graduate Program Director. Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

English (ENGL)

ENGL 5002. Women and Literature. (3) Selected topics focusing on women and literature, such as images of women, women as writers, and women as literary critics. *May be repeated for credit with change of topic and permission of department.* (However, only six hours may be used for the requirements for the English major.)

ENGL 5008. Topics in Advanced Technical Communication. (3) Exploration, both theoretically and practically, of the interrelation of written, oral, graphic, and digital communication within technical rhetorical contexts. *May be repeated for credit one time with permission of department.*

ENGL 5050. Topics in English. (3) Special topics not included in other courses. *May be repeated for credit with permission of department.*

ENGL 5072. Topics in Literature and Film. (3) Cross-listed Course(s): ENGL 4072. Selected topics in literature and film. *May be repeated for credit with change of topic.*

ENGL 5074. Topics in Children's Literature, Media, and Culture. (3) Cross-listed Course(s): ENGL 4074. Selected topics in children's literature and culture. *May be repeated for credit with change of topic.*

ENGL 5075. Topics in Linguistics. (3) Selected topics in linguistics. *May be repeated for credit with change of topic.*

ENGL 5090. Major Authors. (3) The works, ideas and life of one to three significant authors. May be repeated once for credit as long as different authors are studied, and with departmental approval.

ENGL 5102. British Children's Literature. (3) Focuses on works in British and British Colonial Children's Literature. *May be repeated for credit with change of topic.*

ENGL 5103. American Children's Literature. (3) Focuses on works in American Children's Literature. *May be repeated for credit with change of topic.*

ENGL 5104. Multiculturalism and Children's Literature. (3) Focuses on works that represent one or more kinds of cultural, ethnic, or social diversity of the United States and other national literatures. *May be repeated for credit with change of topic.*

ENGL 5114. Milton. (3) A study of the major poems and selections from the minor works of Milton.

ENGL 5116. Shakespeare's Early Plays. (3) A study of 10 representative plays from the comedies, histories and tragedies written 1590-1600.

ENGL 5117. Shakespeare's Late Plays. (3) A study of 10 representative plays from the period 1600-1611, including the late tragedies and tragi-comedies.

ENGL 5121. The 18th-Century British Novel. (3) The novel as narrative form and as mirror of the individual in society. Emphasis on fiction by Defoe, Richardson, Fielding, Sterne, Austen, with further readings in the novel of manners and the Gothic romance.

ENGL 5122. The Victorian Novel. (3) Readings in British fiction during the triumph of the novel in the 19th century, emphasizing major developments in realism, romance, naturalism.

ENGL 5123. The Modern British Novel. (3) Representative British novels that embody the cultural and literary developments of the 20th century: the impact of two world wars, the influence of important psychological and economic factors of modern life and their relationships to new techniques in art and literature.

ENGL 5124. Modern Irish Literature. (3) Readings in Irish literature since 1885, with consideration of the mythology, folklore, and social history of Ireland as they are expressed in poetry, drama and fiction.

ENGL 5131. British Drama to 1600, Excluding Shakespeare. (3) A survey of the development of British drama to 1600, with representative plays from the Mystery-Miracle Cycles, the Morality Plays, and Tudor drama, including Lyly, Kyd, Marlowe, Peele, Greene, Dekker.

ENGL 5132. British Drama from 1600-1642, Excluding Shakespeare. (3) A survey of Jacobean and Caroline drama, including plays by Jonson, Beaumont and Fletcher, Webster, Middleton, Shirley, Ford.

ENGL 5133. British Drama of Wit and Intrigue, 1660-1780. (3) The famous bawdy comedy of manners and the heroic drama of the Restoration, followed by the sentimental comedy and satiric burlesque of the 18th century.

ENGL 5143. The American Novel of the 19th Century. (3) Major novelists and traditions from the beginnings of the American novel through the rise of realism, including such novelists as Hawthorne, Melville, Twain, Howells, James.

ENGL 5144. The American Novel of the 20th Century. (3) Major novelists and traditions from the emergence of naturalism to the present, including such novelists as Crane, Dreiser, Hemingway, Faulkner.

ENGL 5145. Literature of the American South. (3) Selected works of Southern writers which reflect literary and cultural concerns from Colonial times to the present, including such authors as Poe, the early humorists, local color writers, Chopin, Faulkner, Warren, O'Connor, Welty.

ENGL 5146. Contemporary Jewish-American Literature. (3) An introduction to the scope and shape of the contemporary Jewish-American literary traditions. Such writers as Bellow, Malamud, Roth, Singer, and Potok are studied.

ENGL 5147. Early Black American Literature. (3) Prerequisite(s): ENGL 2301. A survey of significant writings by black Americans before the Harlem Renaissance.

ENGL 5148. 20th Century Black American Literature: Prose. (3) Intensive study of selected black American 20th century writers of fiction and nonfiction, beginning with the Harlem Renaissance.

ENGL 5150. Contemporary Poetry. (3) Poetry in English (including translations) since 1940.

ENGL 5151. Modern Drama. (3) Representative Continental, British, and American plays, from Shaw to the present.

ENGL 5152. Modern European Literature. (3) Selected modern European authors, translated into English, whose works have been of special interest to readers and writers of British and American literature.

ENGL 5153. Contemporary Fiction. (3) Selected present-day fiction, with an emphasis upon works from outside the United States and Britain. Works not originally in English will be studied in translation.

ENGL 5155. Pan-African Literature. (3) Introduction to significant Pan-African literature, emphasizing the oral tradition, selected works of major authors in the Caribbean and Africa, and the relationships of these traditions to

American, British and other literary traditions. Works not originally written in English will be studied in translation.

ENGL 5156. Gender and African American Literature. (3) Cross-listed Course(s): AFRS 4106. Prerequisite(s): ENGL 2301, 3100 and 3200, or permission of instructor or graduate status. Exploration of the intersection of gender and African American Literature, focusing on either Black women writers or Black male writers, or a combination in dialogue.

ENGL 5157. African American Poetry. (3) Cross-listed Course(s): AFRS 4107. Prerequisite(s): ENGL 2301, 3100 and 3200, or permission of instructor or graduate status. Intensive study of African American poetry, focusing on one period or traversing several.

ENGL 5158. African American Literary Theory and Criticism. (3) Cross-listed Course(s): EDCI 8135. Prerequisite(s): ENGL 2301, ENGL 3100, and ENGL 3200, or permission of instructor or graduate status. History of an African American approach to literary analysis, including a practicum in modern criticism.

ENGL 5161. Modern English Grammar. (3) A study of the structure of contemporary English, with an emphasis on descriptive approaches.

ENGL 5165. Multiculturalism and Language. (3) Readings in and discussion and application of the interrelationships between language and culture, including basic introduction to contemporary American dialects and to social contexts of language.

ENGL 5166. Comparative Language Studies for Teachers. (3) Prerequisite(s): ENGL 3132, ENGL 6161, or permission of the department. An introductory course designed to aid the teacher of English as a Second Language in comparing the systems of sound and structure of another language with those systems in English.

ENGL 5167. The Mind and Language. (3) Introduction to the study of the mind from a linguistic perspective. Topics include: language growth and loss; language deficits; modularity and hierarchical processing; the interaction of cognitive and linguistic faculties; parsing/processing strategies; and limitations and applications such as therapy, forensics, computing, and teaching.

ENGL 5180. Theories of Technical Communication. (3) Rhetorical, psychological, and anthropological theories that underscore the interrelations of written graphic, and digital communication within technical, rhetorical contexts.

ENGL 5181. Writing and Designing User Documents. (3) Researching and analyzing audiences to write publishable instructions. This includes the production, testing, and revision of tutorials, reference manuals, online documents, and digital media for users of computers and other technologies.

ENGL 5182. Information Design and Digital Publishing. (3) Theoretical and practical exploration of visual communication. By rhetorically integrating text and graphics, students will write and publish documents and online content for digital environments.

ENGL 5183. Editing with Digital Technologies. (3) Substantive editing, copyediting, project management, and editing in hardcopy documents and web and digital environments.

ENGL 5200. Teaching of Writing. (3) Cross-listed Course(s): ENGL 4200. Introduction to various theories that inform practices in the teaching of writing and methods of teaching writing to middle and secondary learners.

ENGL 5201. Teaching Multiethnic Literature. (3) Cross-listed Course(s): ENGL 4201. An overview of the issues, opportunities, and challenges of teaching multiethnic literature in middle and secondary school settings.

ENGL 5202. Writing Poetry. (3) Further study of and practice in the writing of poetry within a workshop format. *May be repeated for credit one time with permission of department.*

ENGL 5203. Writing Fiction. (3) Cross-listed Course(s): ENGL 4203. Further study of and practice in the writing of fiction within a workshop format. *May be repeated for credit one time with permission of department.*

ENGL 5204. Expository Writing. (3) Writing of essays, criticism, and various forms of exposition.

ENGL 5205. Advanced Expository Writing. (3) Prerequisite(s): ENGL 5204. Advanced writing of essays, criticism, and various forms of exposition. *May be repeated for credit one time with permission of department.*

ENGL 5206. Writing Creative Nonfiction. (3) Cross-listed Course(s): ENGL 4206. Combines the reading and discussion of published creative nonfiction with the writing of original creative works. *May be repeated for credit one time with permission of department.*

ENGL 5207 Writing Young Adult Fiction. (3) Cross-listed Course(s): ENGL 4207. Today, the young adult (YA) novel is often a beautifully crafted work of literary fiction open to a variety of experimental approaches. This course serves those who already write, or would like to try writing, YA fiction. It explores aspects of reading and

writing young adult fiction, including developing a narrative point of view, trajectory and conflict, creating complex characters, and issues of voice and style.

ENGL 5208. Poetry Writing Workshop. (3) Designed for advanced writers of poetry. Focuses primarily on student work and peer criticism of it. *May be repeated for credit one time with permission of department.*

ENGL 5209. Fiction Writing Workshop. (3) Designed for advanced writers of fiction. Focuses primarily on student work and peer criticism of it. *May be repeated for credit one time with permission of department.*

ENGL 5210. Greek and Roman Drama in Translation. (3) A study of selected plays of Aeschylus, Sophocles, Euripides, Aristophanes, Plautus, Terence, and Seneca with emphasis on dramaturgy and the development of the Greek and Roman theater.

ENGL 5211. Chaucer. (3) The poetry of Geoffrey Chaucer, including the Canterbury Tales and Troilus and Criseyde.

ENGL 5235. History of the Book. (3) Cross-listed Course(s): ENGL 4235. Explorations of the development, technologies, cultures, and impact of the book and print media.

ENGL 5251. Literary Criticism Through Arnold. (3) The major schools and critics of literary criticism.

ENGL 5252. Modern Literary Criticism. (3) Theories of the modern schools of criticism.

ENGL 5254. Teaching English/Communications Skills to Middle and Secondary School Learners. (3) Cross-listed Course(s): ENGL 4254. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): MDSK 5100L. Approaches to the teaching of English, including recent theories and research related to writing and literary study, designed primarily for teaching in grades 6-12.

ENGL 5260. History of the Global Englishes. (3) Cross-listed Course(s): ENGL 4260. Origins and development of the English language, both spoken and written, from its earliest forms to contemporary usage.

ENGL 5262. Language and Diversity. (3) Cross-listed Course(s): ENGL 4262. Examination of contemporary American varieties of English by region, gender, ethnic identity, socioeconomic status, age, social networks, and other cultural groupings.

ENGL 5263. Linguistics and Language Learning. (3) Cross-listed Course(s): EDCI 8129. Readings in, discussions of, and application of linguistically oriented theories of language acquisition, directed toward gaining an understanding of language-learning processes and stages.

ENGL 5264. Literacy in Family and Community. (3) Exploration of literacy issues and outreach in schools, agencies, and work sites.

ENGL 5270. Studies in Writing, Rhetoric, and Literacy. (3) Cross-listed Course(s): ENGL 4270. Studies of writing, rhetoric, and literacy with an emphasis on historical and cultural contexts. *May be repeated for credit with change of topic and permission of department.*

ENGL 5271. Studies in Writing, Rhetoric, and New Media. (3) Cross-listed Course(s): ENGL 4271. Studies of writing, rhetoric, and new media and digital technologies with an emphasis on historical and cultural contexts.

ENGL 5272. Studies in the Politics of Language and Writing. (3) Cross-listed Course(s): ENGL 4272. Explores language and writing as sites of political contestation in local, national, and global contexts. Examines theoretical debates and effects of politics and history on language and learning.

ENGL 5274. Visual Rhetoric. (3) Cross-listed Course(s): ENGL 4274. Theory and practice of crafting rhetorical arguments in print and electronic media that depend upon visual exhibits, such as drawings, photographs, tables, graphs, icons, and videos.

ENGL 5275. Rhetoric and Technology. (3) Cross-listed Course(s): ENGL 4275. Research and theories of the rhetorical construction of technology in history and culture.

ENGL 5277. Digital Literacies. (3) Cross-listed Course(s): ENGL 4277. Exploration of the intersections between evolving digital literacies and traditional school-based literacies.

ENGL 5280. Writing about Place. (3) Cross-listed Course(s): ENGL 4051. As writers of nonfiction, students write about specific places by researching their histories and imagining their futures, whether those places are preserved, threatened, stagnant, or revitalized. Through drafting, editing, and multiple revisions, students produce illustrated work suitable for publication consideration.

ENGL 5290. Advanced Creative Project. (3) The planning, writing, and polishing of a work of at least 20 pages of poetry or at least 40 pages of fiction or creative non-fiction with the guidance of a member of the Department's creative writing faculty. The final work may be a single piece or a collection of pieces and will evolve under the supervision of the primary instructor. With permission of the department, students who took the

course as undergraduates may repeat as graduate students.

ENGL 5325. Trauma and Memory in Contemporary American Literature. (3) Cross-listed Course(s): ENGL 4325. Examination of selected works that explore national experiences of trauma in the U.S.

ENGL 5400. Research, Theory, and Practice of Tutoring Writing. (3) Cross-listed Course(s): ENGL 4400 and WRDS 4402. Prerequisite(s): Interview and permission of Writing Resources Center Director and/or Assistant Director. A practicum which educates student peer tutors to assist writers in UNC Charlotte's Writing Resources Center (WRC). All writing consultants are required to complete this course, which provides an introduction to writing center research, theory, and practice. Coursework explores the history, contexts, and research-based principles of writing centers; the social, collaborative nature of learning; strategies of one-with-one writing instruction; threshold concepts in Writing Studies; composition theory; and current issues in writing pedagogy, such as linguistic justice and accessibility. Significant attention is given to research-based practices for supporting multilingual writers. In addition to completing coursework, students tutor in the WRC for three hours per week. Because this course includes a practicum in the WRC, enrollment is by permission only, following a successful interview with the Director and/or Associate Director of the WRC.

ENGL 5410. Professional Internship. (3, 6) Prerequisite(s): Permission of English Internship Coordinator; Junior, Senior, or Graduate standing; English major, English minor, or Communication Studies minor; minimum 2.5 GPA; and a course in professional communication (e.g., journalism, technical communication, public relations, public relations lab, or mass media). Students work 8-10 hours (for 3 credit hours) or 16-20 hours (for 6 credit hours) per week in a placement arranged by the Internship coordinator. Only three credit hours may be applied to the English major at either the undergraduate or graduate level; three additional hours may be counted as a University or Communications elective.

ENGL 5852. Independent Study. (1 to 3) Prerequisite(s): Permission of the department. Individual investigations and appropriate exposition of the results. (Unless special permission is granted by the Department Chair, no more than six hours may apply toward the English major.) *May be repeated for credit with permission of department.*

ENGL 6008. Topics in Advanced Technical Communication. (3) Theoretical and practical exploration of advanced topics in technical communication, including projects in which students write and publish documents by rhetorically integrating text, graphics, and other media using computer aids. *May be repeated for credit with change of topic.*

ENGL 6062. Topics in Rhetoric. (3) Examination of and/or research concerning selected issues in rhetorical theory or pedagogy. *May be repeated for credit with change of topic and permission of department.*

ENGL 6070. Topics in English. (3) Selected topics of literature, rhetoric/writing, and language. *May be repeated for credit with change of topic and permission of department.*

ENGL 6072. Topics in Literature and Film. (3) Selected topics in literature and film. *May be repeated for credit with change of topic.*

ENGL 6073. Topics in Creative Writing. (3) Selected topics in creative writing. *May be repeated for credit with change of topic.*

ENGL 6101. Introduction to English Studies. (3) Cross-listed Course(s): EDCI 8131. The discipline of English--its nature, its history, and its methods. Emphasis on (1) the interrelations of literature, language, and writing; and (2) the diversity of cultural origins and critical perspectives in English studies, with concentration on selected major critical approaches. Intensive writing and practice in methods of research. Required of all M.A. in English students, preferably at or near the beginning of their programs.

ENGL 6102. Literary Theory. (3) Cross-listed Course(s): EDCI 8132. Modern literary theory focusing on the theoretical concepts which underpin literary analysis. Emphases may differ from semester to semester; readings will focus on major theoretical statements and on criticism which applies several approaches to particular literary works. Students are required to apply what they have learned.

ENGL 6103. Introduction to Children's Literature and Culture. (3) Covers a range of texts for children and adolescents, including both historical and contemporary works.

ENGL 6104. Major Figures and Themes in Children's Literature. (3) Cross-listed Course(s): EDCI 8133. Focuses on significant authors, illustrators, or themes in children's and/or adolescent literature. *May be repeated for credit with change of topic and permission of department.*

ENGL 6111. Shakespeare's Comedies and Histories. (3) Source materials, textual problems and stage conventions in selected comedies and history plays illustrating Shakespeare's dramaturgy.

ENGL 6112. Shakespeare's Tragedies. (3) Source materials, textual problems and stage conventions of the great tragedies, illustrating Shakespeare's dramaturgy.

ENGL 6113. Milton. (3) The complete poetry and selections from the prose.

ENGL 6116. Technical/Professional Writing. (3) Prerequisite(s): Graduate or Post-Baccalaureate Graduate standing. An introduction to the theoretical and practical exploration of key issues and developments in the field of technical/professional writing. Students will write and publish print and online documents by rhetorically integrating text and graphics. Students in the Technical/Professional Writing Concentration are expected to enroll in 6116 as their first or second course in the program.

ENGL 6123. The Augustan Age, 1660-1785. (3) Close reading of Dryden, Pope, Swift, Johnson, and a consideration of other literary figures and trends, in the light of intellectual and historical currents.

ENGL 6125. The Romantic Era, 1785-1832. (3) Development of the Romantic movement, with emphasis on the works of Wordsworth, Coleridge and other major poets.

ENGL 6126. The Victorian Era, 1832-1900. (3) Emphasis on Tennyson, Robert Browning, Arnold, Carlyle, Ruskin, Newman.

ENGL 6127. Seminar in Language, Culture, and Society. (3) Recommended Prerequisite(s): an introductory course in linguistics. Discussions on topics such as the complex relationships between language and culture, how language affects perception and cognition, and how language affects the individual's sense of self and the group's sense of community.

ENGL 6141. American Romanticism. (3) Major writers of the 1830s, 40s, and 50s, including Hawthorne, Melville, Whitman, Emerson, Thoreau, and the Transcendental Movement.

ENGL 6142. American Realism and Naturalism. (3) Major writers of the two movements before and after the end of the 19th century, including Twain, Howells, James, Crane, Dreiser, Norris.

ENGL 6143. American Modernism. (3) Six to eight writers of the period since World War I, both prose and poetry.

ENGL 6144. Stylistics. (3) Methodologies for analysis of the style of texts, with special emphasis on diction, syntax, prose, rhythm, voice, and metaphor.

ENGL 6147. Perspectives in African American Literature. (3) Cross-listed Course(s): EDCI 8134. A survey of African American literature, emphasizing the major authors, those relevant historical and social factors, and those specific literary movements that have influenced the development of African American literature.

ENGL 6160. Introduction to the English Language. (3) History and nature of English, its grammar, syntax, and lexicon. Integrates the study of language-based rhetorical and literary theory, asks students to consider the nature of language in general, its impact on the user, and the development of the systems of English, concentrating on features of major British and American dialects and registers. Required of all M.A. in English students, preferably at or near the beginning of their programs.

ENGL 6161. Introduction to Linguistics. (3) Introduction to linguistics, its techniques and objectives, descriptive and historical approaches, language families, language and culture.

ENGL 6162. History of the English Language. (3) Origins and development of spoken and written English, from its earliest forms to contemporary usage, with some attention to dialects and lexicography. (May not also receive credit for ENGL 4260.)

ENGL 6163. Understanding Language Learning: Mind, Identity, and the Sociocultural World. (3) Prerequisite(s): ENGL 6160 or permission of instructor. Theories of language learning processes and their intersection with mind, identity, and sociocultural contexts. Credit will not be given for ENGL 6163 where credit has been given for ENGL 4263.

ENGL 6164. Comparative Language Analysis for Teachers. (3) An introduction to the theory and practice of contrastive language analysis. Examination of universal features of the process of second language acquisition and the effects of a learner's first language on the acquisition of a second language, and explore how teachers can use such knowledge to facilitate the learner's acquisition of a second language.

ENGL 6165. Introduction to English for Specific Purposes. (3) Cross-listed Course(s): EDCI 8137. An introduction to learner-centered approaches to teaching English as a Second Language (ESL) and English as a Foreign Language (EFL) to non-native learners who need to learn English for a very definite academic, professional or vocational purpose.

ENGL 6166. Rhetorical Theory. (3) Cross-listed Course(s): EDCI 8138. Rhetorical theories, past and present, focusing on ways that these varied frameworks of understanding have informed the generation, understanding, and

pedagogy of writing and other modes of discourse. Emphases vary from semester to semester, readings concentrate on major selected rhetorical theories and on implications of these theories for the understanding and pedagogy of discourse.

ENGL 6167. Research Methods in Applied Linguistics. (3) Prerequisite(s): ENGL 6161 or permission of instructor. An introduction to the major components of designing and carrying out a research project in applied linguistics.

ENGL 6168. Practicum in English for Specific Purposes. (3) Prerequisite(s): Permission of the Graduate Program Director. Provides supervised experiences in teaching in an educational setting outside the public schools with an emphasis on developing skills as an education professional.

ENGL 6181. Composition Theory and Pedagogy. (3) An introduction to various theories that shape composition and its teaching.

ENGL 6182. Research Theory and Method in Rhetoric and Composition. (3) An exploration of research in Rhetoric and Composition Studies, including various methods of conducting research and their implications for knowledge-making in the field.

ENGL 6183. Critical Pedagogy and the Teaching of Writing. (3) Explores how ideologies and ideas of literacy shape practices in the teaching of writing.

ENGL 6195. Teaching College English. (3) Examination of major issues in the theory and practice of literature and composition instruction at the college level.

ENGL 6274. Contexts and Issues in the Teaching of English. (3) Cross-listed Course(s): EDUC 6274. Prerequisite(s): Admission to the Program. Examine key concepts of the discipline. In doing so, students consider their own identities as readers, writers, teachers, researchers, and makers of meaning. Emphasizes critical approaches and pedagogical issues, with special attention given to technology in the teaching of language, composition, and literature, as well as cultural contexts for the study of English.

ENGL 6495. Internship in College Teaching. (3) Prerequisite(s): ENGL 6195. Teaching in one section offered by the Department of English under the supervision of English faculty. Students will be accepted for internship only near the end of the degree program and upon approval of the Department. Students will be assigned to teach selected basic courses, and also will participate in periodic conferences and seminars. It is strongly recommended that students also take ENGL 4400 before ENGL 6195.

ENGL 6496. Practicum in Teaching College English. (1) Prerequisite(s): Permission of Graduate Program Director. Practicum designed to prepare students to teach courses in English studies. *Graded on a Pass/Unsatisfactory basis.*

ENGL 6674. Applied Research Methods in the Teaching of English. (3) Cross-listed Course(s): EDCI 8121. Provides the opportunity to apply research methods in classrooms. Examine identities as readers, writers, teachers, and especially as classroom researchers.

ENGL 6680. Seminar in British Literature. (3) Study of a topic in British Literature. *May be repeated for credit with change of topic.*

ENGL 6685. Seminar in American Literature. (3) Study of a topic in American Literature. *May be repeated for credit with change of topic.*

ENGL 6687. Seminar in Global Literature. (3) Study of a topic in global literature. *May be repeated for credit with change of topic.*

ENGL 6890. Directed Reading. (1 to 3) An independent study of a topic in English that a student arranges individually with their graduate program director.

ENGL 6895. Project. (3) Appropriate research and written exposition of that research, which may or may not be an outgrowth of work done in previous courses. If the project is the outgrowth of previous coursework, additional research and exposition must be done beyond that previously undertaken. Based on a written proposal from the student, the project is directed by a graduate faculty member appropriate to the topic, appointed by the Graduate Program Director after consultation with the student, and defended before three graduate faculty members. It is recommended that project work not be undertaken until near the end of the student's program. A Creative project option is available for students who have completed appropriate coursework in Creative Writing. A statement of recommendations and requirements for form and procedures is available in the Department of English. *May be repeated for credit three times for students in the M.A./M.F.A. dual degree program.*

ENGL 6974. Thesis/Project in the Teaching of English. (6) Prerequisite(s): Permission of the department. Research integrating the fields of English and Education in a theoretical or application-oriented study. If the thesis/project is the outgrowth of previous coursework, considerable additional research and exposition must be done.

ENGL 6996. Thesis. (6) Appropriate research and written exposition of that research, which may or may not be an outgrowth of work done in previous courses. If the thesis

is the outgrowth of previous coursework, considerable additional research and exposition must be done beyond that previously undertaken. The proposed thesis work, as well as the final product, is approved by a committee of three graduate faculty appropriate to the topic, appointed by the Graduate Program Director after consultation with the student, on the basis of a written proposal from the student. It is recommended that thesis work not be undertaken until near the end of the student's program. The thesis title is to be shown on the student's final transcript. A Creative thesis option is available for students who have completed appropriate coursework in Creative Writing. A statement of recommendations and requirements for form and procedures is available in the Department of English. *Graded on a Standard Letter Grade basis each term.*

Engineering (ENGR)

ENGR 5090. Special Topics. (1 to 4) Directed study of current topics of special interest. *May be repeated for credit.*

Earth Sciences (ESCI)

ESCI 5000. Selected Topics in Earth Sciences. (1 to 4) Prerequisite(s): ESCI 1101, GEOL 1200 and GEOL 1200L, or permission of instructor. In-depth treatment of specific topics selected from one of the fields of the earth sciences. *May be repeated for credit with change of topic.*

ESCI 5105. Meteorological Computer Applications. (3) Prerequisite(s): METR 3140 and MATH 1241 with grades of C or above, or permission of instructor. Principles of computer programming applied to the analysis of meteorological data. Students become familiar with the Unix environment, learn programming basics, and create programs to analyze various meteorological datasets. Topics include: program composition, compiling, data types, mathematical operators, selective execution, repetitive execution, arrays, functions, and subroutines. Three hours of combined lecture and lab per week.

ESCI 5110. Atmospheric Instrumentation. (3) Prerequisite(s): METR 3210 with a grade of C or above, or permission of the instructor. An overview of common atmospheric measurements systems and their applications. Particular attention is paid to surface, sounding, radar, and satellite systems. Three hours of combined lecture and lab per week.

ESCI 5122. Statistics and Data Analysis in Earth Sciences. (3) Cross-listed Course(s): ESCI 4122. Prerequisite(s): Permission of instructor. Develop techniques in a programming environment to quantitatively summarize spatiotemporal data related to Earth sciences using univariate and bivariate statistical calculations; defend interpretations of spatiotemporal Earth science data from both statistical and physical perspectives.

ESCI 5140. Hydrologic Processes. (4) Prerequisite(s): ESCI 1101; GEOL 1200 and GEOL 1200L; or permission of instructor. Atmospheric, soils and geologic aspects of surface and ground water processes. Three lecture hours and one three-hour lab per week.

ESCI 5150. Applied Climatology. (3) Prerequisite(s): METR 3250 or permission of instructor. Methods of acquiring and analyzing climactic data in various types of applied problems. Emphasis on methods to assess and reduce the impact of weather and climate upon human activities. Three hours of combined lecture and lab per week.

ESCI 5155. Fluvial Processes. (4) Prerequisite(s): ESCI 1101 and ESCI 1101L; GEOL 1200 and GEOL 1200L; or permission of instructor. Hydrologic and geomorphic study of the transport of water and earth materials within stream systems. Erosion, mass wasting, open channel flow, sediment transport, flooding, stream channel morphology, morphometry of drainage basins, and related topics. Three lecture hours, three lab hours per week.

ESCI 5170. Fundamentals of Remote Sensing. (4) Prerequisite(s): ESCI 1101 and GEOL 1200, or permission of instructor. Introduces the physical fundamentals of remote sensing, provides an overview of airborne and satellite remote sensing systems, and offers a basic instruction in the use and interpretation of remote sensing imagery. Identification, interpretation and mapping of both natural and cultural landscape features are also covered. One 2-1/2 hour lecture and one three-hour lab per week.

ESCI 5180. Digital Image Processing in Remote Sensing. (4) Offers both a basic instruction in the use and interpretation of remote sensing data, and advanced remote sensing techniques to help students understand what and how remote sensing can contribute to the information needs in various fields. 2-1/2 lecture hours and three lab hours per week.

ESCI 5190. Contemporary Environmental Issues. (3) Cross-listed Course(s): ESCI 4190. An overview of current environmental issues. Solutions to environmental problems are not always clear-cut; this course focuses on the controversies, debates, and clashing views.

ESCI 5201. Hydroclimatology. (3) Cross-listed Course(s): ESCI 4201. Prerequisite(s): Graduate standing and Admission to M.S. in Earth Science program. Exploration of the climatic, meteorological, and geographic processes that determine water availability for human use and vegetation growth across Earth's ecosystems.

Precipitation in tropical and extratropical weather systems; climate and land-surface factors that drive runoff, evaporation and photosynthesis; effects of long-term climate and CO2 changes.

ESCI 5205. Climate Dynamics. (3) Prerequisite(s): ESCI 3101 and METR 4105 with grades of C or above. Pre- or Corequisite(s): METR 3250 or permission of instructor. Topics include: global climate, climate variability, and dynamics within the climate system, with a focus on the role of the atmosphere in the climate system. The El Niño phenomenon provides the main example of how climate variability can affect weather, and seasonal weather forecasting. Three hours of combined lecture and lab per week.

ESCI 5210. Soil Science. (4) Prerequisite(s): GEOL 3124 and GEOL 3115, or permission of instructor. Study of soils, soil-forming processes and soil morphology with an emphasis on soils as they relate to geologic landscapes and surficial processes. Students will learn how to describe and interpret soils in the field. Three hours lecture, three hours lab per week with occasional field trips. Graduate students will fulfill the requirements of ESCI 4210. In addition, graduate students will be required to acquire laboratory and interpretive skills in soil chemical analyses and will have additional writing assignments for the course.

ESCI 5214. Global Ecosystems: Human Dimensions, and Environmental Dynamics. (3) Cross-listed Course(s): ESCI 4214. A multi-disciplinary course that surveys the history and prehistory of human ecological dynamics, drawing on geology, geography, and ecology to understand the interrelationships between global climates, global ecosystems, and their human inhabitants. Topics include: climatic change and its impacts on biological systems, peopling of new landscapes, anthropogenic vegetation change, extinctions, desertification, invasive species interactions, and changes in human subsistence.

ESCI 5220. Atmospheric Chemistry. (3) Prerequisite(s): CHEM 1251 and MATH 1242 with grades of C or above, or permission of instructor. Basic physical chemistry and a survey of major topics in atmospheric chemistry including fundamental properties of the atmosphere, tropospheric chemistry, air pollution, acid rain, stratospheric chemistry and the ozone hole, and the role of chemistry in the Earth's climate. Three hours of combined lecture and lab per week.

ESCI 5222. Watershed Science. (3) Prerequisite(s): ESCI 4140 or ESCI 5140, or permission of instructor. Examination of the cycling of water and chemical elements in natural and perturbed watersheds with emphasis on linkages between the hydrologic and biogeochemical processes which control runoff water quality. Topics include: runoff processes, evapotranspiration, nutrient export and stream, riparian and hyporheic zone hydrochemical dynamics.

ESCI 5233. Geoenvironmental Site Characterization. (4) Prerequisite(s): Earth Sciences, Geology and M.A. Geography majors: ESCI 4140 or ESCI 4155; others: permission of instructor. Advanced field-based examination of hydrologic and geologic conditions in the southeastern United States within the context of current state and federal regulatory requirements and site characterization activities currently performed by professional environmental geoscientists. Hydrologic investigation and water quality characterization, and geological and geophysical site investigations.

ESCI 5240. Boundary-Layer Meteorology. (3) Prerequisite(s): METR 3210 or permission of instructor. Examines the flow of mass, energy, and moisture within the planetary boundary layer including their exchange at the earth's surface and theories of interaction. Principles of air pollution including sources, sinks, and controls. Interaction of the atmosphere with underlying surfaces (i.e., soils, vegetation, oceans, glaciers). Design and operation of instruments used to monitor the atmosphere with an emphasis on practical application. Three hours of combined lecture and lab per week.

ESCI 5250. Advanced Dynamic Meteorology. (3) Prerequisite(s): METR 3250 with a grade of C or above, MATH 2171, and MATH 2241, or permission of instructor. In-depth examination of atmospheric dynamics, focusing on the structure and evolution of synoptic and mesoscale weather systems, wave dynamics (Rossby, topographic, inertia-gravity, etc.), scale-analysis, nondimensional numbers, and atmospheric modeling. Three hours of combined lecture and lab per week.

ESCI 5251. Advanced Synoptic Meteorology. (3) Prerequisite(s): METR 3250 with a grade of C or above or permission of instructor. An integrated view of synoptic and dynamic meteorology focusing on advanced conceptual models and analysis techniques for mid-latitude weather systems and regional precipitation events. Three hours of combined lecture and lab per week.

ESCI 5320. Tropical Meteorology. (3) Prerequisite(s): METR 3250 or permission of instructor. A comprehensive study of the tropical atmosphere, including climatology, mean structure and circulation, air-sea energy exchange, cumulus transport, synoptic waves, and tropical storms. Special attention is paid to the formation, evolution, motion, and societal impacts of hurricanes. Three hours of combined lecture and lab per week.

ESCI 5350. Mesoscale Meteorology. (3) Pre- or Corequisite(s): METR 3250 or permission of instructor. A comprehensive study of the structure, evolution, and

dynamics of atmospheric phenomena having spatial scales between 2 and 2000 km. Topics include: fronts, convective initiation, mesoscale convective systems, severe thunderstorms, tornadoes, low-level jets, drylines, land-sea breezes, shallow convection, and terrain effects. Three hours of combined lecture and lab per week.

ESCI 5400. Internship in Earth Sciences. (3 to 6)
Prerequisite(s): Permission of the Graduate Committee. Research and/or work experience designed to be a logical extension of a student's academic program. The student must apply to Graduate Advisory Committee for an internship by submitting a proposal which specifies the type of work/research experience preferred and how the internship will complement his or her academic program. The Graduate Committee will attempt to place the selected students in cooperating community organizations to complete specified research or work-related tasks which are based on a contractual arrangement between the student and community organization. The student can receive three to six hours credit, depending on the nature and extent of the internship assignment.

ESCI 5800. Individual Study in Earth Sciences. (1 to 4)
Prerequisite(s): Permission of instructor and credit hours established in advance. Tutorial study or special research problems. *May be repeated for credit with change of topic.*

ESCI 6000. Selected Topics in Earth Sciences. (1 to 4)
Prerequisite(s): permission of the Earth Sciences Graduate Program Director. In-depth treatment of specific topics selected from one of the concentrations in earth sciences (Solid Earth Sciences; Climatology and Hydrology; Environmental Systems Analysis). *May be repeated for credit with change of topic.*

ESCI 6060. Earth Sciences Field Investigations. (1 to 6)
Prerequisite(s): Permission of instructor. A concentrated field investigation of selected earth sciences topics. Course subject matter, credit hours, location and duration will be specified each time course is offered. *May be repeated for credit. Graded on a Pass/Unsatisfactory basis.*

ESCI 6105. Landscape Assessment. (4) Cross-listed Course(s): GEOG 8223. Prerequisite(s): GEOL 4105 or permission of instructor. An advanced geomorphology course that examines current climatic and/or tectonic geomorphology research topics and methods with a focus on regional or disciplinary issues that varies each offering. Using a variety of field-based quantitative and qualitative techniques such as laser surveys, GPS, trenching and/or coring, students devise and implement a research project that includes two related but separate field sites. Three hours seminar per week with three or four mandatory field trips.

ESCI 6120. Numerical Modeling of the Earth System. (3)
Cross-listed Course(s): INES 8120. Focuses on fundamental principles and applications of numerical modeling in simulating components of the Earth system, including the atmosphere, land, and water. Philosophical considerations of why and how numerical models and model output are used in the Earth sciences are discussed. Also delves into the technical details of constructing a model, including finite differencing, boundary conditions, and parameterizations, and how these choices influence model output.

ESCI 6201. Earth Systems Analysis: Climate. (3) Current working hypotheses and research methods are reviewed for the study of climatology and climate change. Theories and mechanisms of climate change, as well as the interrelationships between the components of the climate system, are discussed towards understanding and explaining past, present and possible future climatic behavior.

ESCI 6202. Earth Systems Analysis: Biogeochemical Cycles. (3) Cross-listed Course(s): GEOG 8224. Examines the Earth's water and major elemental cycles including those of carbon, nitrogen, sulfur, phosphorus and the major crustal elements. Uncertainties in the current state of understanding of global elemental cycles are examined. Special emphasis is placed on how these cycles are currently being modified through human activities.

ESCI 6222. Quaternary Paleoenvironmental Sciences. (3)
Cross-listed Course(s): GEOG 6222, GEOG 8222, and INES 8222. A multi-disciplinary course which surveys methods used to reconstruct past climates, past environments, and past landscapes during the Quaternary period. Changes in past environmental conditions are discussed in light of present and future landscape predictions emphasizing both natural and human causes. Focuses on biotic and abiotic material from terrestrial and marine sediment cores, ice cores, and other proxies for past environments and past climates.

ESCI 6226. Landscape Ecology. (3) Cross-listed Course(s): GEOG 6226, GEOG 8226, and INES 8226. An introduction to landscape ecology, the study of the interplay between spatial pattern and ecological process. Lectures and in-depth group discussions focus on the fundamental and applied aspects of topics such as habitat fragmentation, animal movement in human-dominated landscapes, landscape legacies, road ecology, and landscape planning.

ESCI 6227. Ecosystem Restoration. (3) Cross-listed Course(s): GEOG 6227, GEOG 8227, INES 8227. Ecosystem restoration has long been used as a method to return the natural structure and function to degraded ecosystems. This course examines the theory and methods used in restoration with a focus on both

terrestrial and freshwater ecosystems. The science and policy of ecosystem restoration are also explored with examples from ecosystems around the world.

ESCI 6229. Geochemical Tracers and Hydrologic Applications. (3) Cross-listed Course(s): GEOG 6229, GEOG 8229, and INES 8229. Examines environmental tracers in surface and subsurface hydrology (streams, lakes, and groundwater) using an applied approach. Tracer techniques include geochemical element fingerprinting, stable isotopes, and residence time estimation.

ESCI 6250. Urban Air Quality. (3) Prerequisite(s): M.S. Earth Science, M.A. Geography, and Ph.D. INES and Public Policy students: METR 4150 and STAT 2221, or permission of instructor. Examination of the relationships between climatic processes and urban air quality with emphasis on trends and patterns. Topics will include health and environmental effects of air pollution, ozone climatology, pollutant transport, transportation related emissions, risk assessment, and air quality management.

ESCI 6301. Earth Systems Analysis: Human Interactions. (3) Current working hypotheses and research methods are reviewed for the regional and global scale coupling of categorical human activities and earth processes. The focus is on GIS-based modeling frameworks for parametric impact assessment.

ESCI 6302. Earth Systems Analysis: Statistical and Risk-based Decision Support Systems. (3) Statistical and risk-based research/decision support methods are reviewed for local and regional environmental assessment and management. The focus is on parametric statistical analysis of large temporal and spatial datasets for the human-interface with the local and regional air, water and land resources. Valuation, ranking, prioritization, and indexing models for environmental management are also discussed.

ESCI 6600. Earth Sciences Graduate Seminar. (1) Prerequisite(s): Admission into the M.S. in Earth Sciences program. Discussion of holistic themes, discipline-specific issues, and current challenges in the Earth Sciences. Students actively participate in seminars delivered by student researchers, faculty, and invited speakers. Participation counts for a total of 2 credit hours (1 credit hour for each of two academic years). Prior to graduation, each student makes at least two seminar presentations and provides at least one formal critique of a presentation. *May be repeated for credit.*

ESCI 6650. Workshop in Earth Sciences. (4) A series of lectures on the subject matter of the atmosphere and hydrosphere with accompanying laboratory sessions.

ESCI 6800. Individual Study in Earth Sciences. (1 to 4) Prerequisite(s): Permission of instructor and credit hours established in advance. Tutorial study or special research problems. *May be repeated for credit with change of topic.*

ESCI 6900. Earth Sciences Research. (1 to 9) Prerequisite(s): permission of the student's research advisor. Students complete hypothesis or problem-driven research that includes formulation, implementation, analysis and presentation components. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

Engineering Technology (ETGR)

ETGR 5301. Environmental Pollution Control. (3) Cross-listed Course(s): ETGR 4301. The major aspects of preventing and controlling air, water, and solid-waste pollution and disposal. Topics include: environmental standards and regulations, engineering controls, remediation techniques, sampling and monitoring, and environmental toxicology.

ETGR 5302. Industrial Hygiene. (3) Cross-listed Course(s): ETGR 4302. Introduces the industrial hygienist's role in characterizing chemical, physical, and biological hazards in the workplace. Topics include: occupational standards and regulations, indoor air quality, ionizing and non-ionizing radiation, thermal stress, sampling/monitoring techniques, personal protective equipment, engineering controls, and program management.

ETGR 5303. Applied Ergonomics and Human Factors. (3) Cross-listed Course(s): ETGR 4303. An overview of the physiological, biomechanical, and psychological concepts related to workplace layout, machine tools, and work methods. An emphasis is placed on the control and prevention of injuries from over-exertion and related musculoskeletal disorders.

ETGR 5305. System Safety Design and Management. (3) Cross-listed Course(s): ETGR 4305. Prerequisite(s): Permission of department. Application of techniques and concepts of system safety methodologies and process safety management. Emphasis on the application of scientific, design and management principles incorporating safety audits, safety management, risk assessment, loss control, and statistical applications across all phases of a system life cycle.

ETGR 5272. Engineering Analysis IV. (3) A continuation of engineering analysis to include additional topics and applications in vector operations, probability, and statistics.

Finance (FINN)

FINN 5158. Student Managed Investment Fund I. (3) Cross-listed Course(s): MBAD 5158. Prerequisite(s): FINN 3120 or MBAD 6152, FINN 3222 or FINN/MBAD 6153, and permission of instructor. Management of an actual portfolio consisting of a portion of the University's Endowment Fund. Students are required to take FINN 5159 following this course.

FINN 5159. Student Managed Investment Fund II. (3) Cross-listed Course(s): MBAD 5159. Prerequisite(s): FINN 5158, FINN 3120 or MBAD 6152, FINN 3222 or FINN/MBAD 6153, and permission of instructor. Management of an actual portfolio consisting of a portion of the University's Endowment Fund.

FINN 5275. Enterprise Risk Management. (3) Cross-listed Course(s): FINN 4275. Prerequisite(s): FINN 3271 or permission of department chair. An in-depth discussion of risk management in non-financial firms, including analysis of techniques that firms use to manage risks. Risk management strategies and how they are applied to business problems are discussed. Some of the techniques examined include self-insurance, captives, financial instruments, and retentions.

FINN 6058. Special Topics in Financial Services. (3) Cross-listed Course(s): MBAD 6160. Prerequisite(s): MBAD 6152. Each year, the subject matter of this course deals with a different specialized and contemporary topic of interest to students who are preparing for management careers in the financial services industry. The topics are chosen and covered in a way that builds on and supplements the topics covered in other courses in the Financial Institutions/Commercial Banking concentration. Emphasis is placed on the managerial implications of the subject matter as well as the impact on the financial system. *May be repeated for credit one time.*

FINN 6151. Financial Institutions and Markets. (3) Cross-listed Course(s): MBAD 6151. Major financial institutions, particularly commercial banks, and their role in the intermediation process and as suppliers of funds to the money and capital markets. Comparative financial policies of these institutions are examined in the context of their legal and market environment.

FINN 6152. Financial Management. (3) Cross-listed Course(s): MBAD 6152 and MSRE 6152. Theory and practice of corporate finance including asset management, cost of capital and capital budgeting, optimization problems and socio-economic aspects of financial management. Computer technology may be employed when applicable.

FINN 6153. Investment Management. (3) Cross-listed Course(s): MBAD 6153. Prerequisite(s): MBAD 6152. Theory and practice of investment decisions of individuals and fund managers. Topics include: the status of capital market theory, the efficient market hypothesis literature, and a portfolio performance measurement. Standard institutional and investment analysis topics, futures and options markets, and international investment topics are covered.

FINN 6154. Applied Business Finance. (3) Cross-listed Course(s): MBAD 6154. Prerequisite(s): MBAD 6152. Examination of business finance topics which typically confront the firm's primary finance functional areas (CFO, Treasurer, Controller). The purpose is to develop advanced analytical skills in those topic areas. Topics include: lease vs. buy (borrow); leveraged buy-outs: merger analysis (emphasis on valuation); international operations of American firms (capital budgeting and cost of capital); capital structure; risk management. Such additional topics as working capital management; risk management; and relevant current topics are included as time permits.

FINN 6155. Multinational Financial Management. (3) Cross-listed Course(s): MBAD 6155. Prerequisite(s): MBAD 6152. Financial management of the multinational firm including management of foreign exchange risk and political risk, and the control and evaluation of financial policies of multinational firms.

FINN 6156. Commercial Bank Management. (3) Cross-listed Course(s): MBAD 6156. Prerequisite(s): MBAD 6152. Techniques for the management of commercial banks. Topics include: industry structure, administrative organization, management of assets, liabilities, and capital, and financial analysis of the banking firm.

FINN 6157. Advanced Corporate Finance. (3) Cross-listed Course(s): MBAD 6157. Prerequisite(s): MBAD 6152. Theories of modern corporate finance, including theory of efficient capital markets; uncertainty and the theory of choice; market equilibrium asset pricing models (capital asset pricing model, arbitrage pricing theory, Black-Scholes); theories of capital structure and the cost of capital; dividend policy; and leasing.

FINN 6203. Financial Economic Theory. (3) Cross-listed Course(s): ECON 6203. Prerequisite(s): Admission to the graduate program and permission of Program Director. The fundamental principles of risk pricing and risk allocation in a unified framework. Discrete-time model is employed to underscore the relationship between the techniques used in finance and the economic analysis of risk. The objective is to understand the economics of asset pricing and how derivatives and options are used in practice and their limitations.

FINN 6210. Financial Elements of Derivatives. (3)
Corequisite(s): FINN 6203 or permission of department. Examines the nature and functions of futures and options markets. Topics include: hedging for risk reduction and the role of derivative instruments in the capital markets. Focuses on basic pricing techniques which are derived from no-arbitrage relations.

FINN 6211. Fixed Income Securities and Credit Risk. (3)
Prerequisite(s): FINN 6210 or permission of department. The fixed income securities and portfolios, as well as the theory and practice of fixed income markets. Topics include: fixed income instruments and sectors, duration and convexity, term structure of interest rates, securitization, portfolio management, hedging, and credit risk.

FINN 6212. Advanced Financial Derivatives. (3)
Prerequisite(s): FINN 6210 or permission of department. Multi-factor derivative pricing models. Topics include: the discrete-time and discrete-state models, Ito processes, relevant topics on stochastic calculus, Risk Neutral Valuation, and review of the Black-Scholes model. Additional topics include: commodity pricing models, stochastic volatility models, multi-period discrete-time (GARCH) models, and the interest rate models such as the Vasicek and CIR models.

FINN 6213. Risk Management and Financial Institutions. (3)
Prerequisite(s): FINN 6203 or permission of department. Topics include: How market risk, credit risk and operational risk are quantified; Basel II regulatory framework; estimation of aggregate economical capital; calculation and use of RAROC; and recent bank risk management tools: back test, CCAR and Dodd-Frank proposals. Also addresses recent big losses that have occurred in financial markets and how they can be avoided.

FINN 6214. Asset and Portfolio Management. (3)
Prerequisite(s): FINN 6203 or permission of department. Provides a foundation in investments and portfolio management from the perspective of an institutional investor. Particular attention is given to the issues associated with managing assets of an insurance company. Topics include: measuring and modeling return and risk, expected return models, information ratio, valuation theory and practice, forecasting, portfolio construction, transaction costs, turnover and trading, performance analysis, asset allocation, securities analysis, and the legal and regulatory landscape of institutional investing.

FINN 6215. Risk Management in Corporations. (3)
Prerequisite(s): FINN 6203 or permission of department. An in-depth discussion of enterprise risk management for all types of firms using the firm value maximization approach, including analysis of techniques that firms use to identify and manage risks. Risks are classified as hazard, operational, strategic, and financial risk. Risk management strategies and how they are applied to business problems in a dynamic business environment are discussed. Some of the strategies examined include insurance, self-insurance, captives, financial instruments, and retention.

FINN 6216. Quantitative Risk Management. (3)
Prerequisite(s): FINN 6203 or permission of department. The quantitative techniques and tools for the risk management, beginning with basic concepts and methodologies. Topics include: risk measures such as VaR and Expected Shortfall, univariate and multivariate models, copulas and tail dependence in risk management framework, and back testing. Also discusses how to estimate VaR and Expected Shortfall parametrically, semi parametrically and non-parametrically.

FINN 6219. Financial Econometrics. (3) Cross-listed Course(s): ECON 6219. Prerequisite(s): ECON 6218, ECON 6113, or STAT 6113. Advanced time series with financial applications. Topics include: time series regressions (univariate and multivariate, stationary and non-stationary) and time series models (including ARMA, ARCH, GARCH, stochastic volatility and factor models). Emphasis placed on model properties, estimators, test statistics, and applications in finance.

FINN 6800. Directed Study in Finance. (1 to 3)
Prerequisite(s): Enrollment in M.S. in Mathematical Finance. Independent study of a theoretical and/or an empirical problem in a specific area of finance. Topics of the investigation may originate from the student or from the faculty member supervising the study. The student's work assignments are designed by the student and faculty member who oversees the project of study. The credit hours are determined prior to enrollment and are based on the particular project undertaken. *May be repeated for credit up to 6 credits and permission of the Graduate Program Director.*

Foreign Language Education (FLED)

FLED 5104. Assessment in the Teaching of K-12 Foreign Languages. (2) Cross-listed Course(s): FLED 4104. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): FLED 5200 and MDSK 5100L. Fosters Foreign Language Education teacher candidates' knowledge and skills of creating and implementing performance-based assessments in K-12 classrooms. Learning modules provide an overview of the major principles involved in foreign language assessment,

focusing on both the theoretical and practical issues. Students practice creating, administering, and scoring assessments of interpretive, interpersonal, and presentational communication, as well as an Integrated Performance Assessment. They also practice analyzing data from such assessments, interpreting necessary changes in instruction based on those data, and providing student feedback.

FLED 5200. Methods in Teaching Foreign Languages. (3) Cross-listed Course(s): FLED 4200. Prerequisite(s): MDSK 5204, MDSK 6162, MDSK 6162L, admission to the Graduate Certificate in Teaching, and permission of department. Pre- or Corequisite(s): MDSK 5100L. Current trends and practices in teaching foreign languages in K-12 schools and addresses state-mandated competencies. The course is required for licensure in the teaching of K-12 Foreign Languages. Includes 25 hours of field experiences.

FLED 5201. K-8 Methods – Foreign Languages. (3) Prerequisite(s): Admission to the Graduate Certificate in Teaching and permission of department. Current trends and practices in teaching foreign languages in the elementary school and the middle school (K-8), with emphasis on practical applications. Addresses state mandated competencies. Required for licensure in the teaching of French, German, or Spanish (K-12).

FLED 6200. Advanced Methods of Teaching Foreign Languages. (3) Cross-listed Course(s): TESL 6476. Prerequisite(s): Admission to the M.A.T. in Foreign Language Education and completion of Phase I of the program. A variety of topics will be addressed in order to prepare experienced second language teachers to be critical thinkers, second language researchers, and instructional and program leaders. Exemplar topics include the analysis of instructional methods and teaching strategies, curriculum design, research-based practices, multicultural education, and the mentoring and/or professional development of novice ESL teachers.

FLED 6470. Graduate Student Teaching and Internship – Foreign Language Education. (3 to 6) Prerequisite(s): Completion of all education coursework required for the "A" license, background requirements, minimum score of Advanced-Low on the Oral Proficiency Interview (OPI), and an application for the course by the established deadline; and approval of the department. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

French (FREN)

FREN 5003. Studies in French Literature. (3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. Major topics in French literature. *May be repeated for credit with change of topic.*

FREN 5005. Studies in the French Language. (3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. Major topics in the French language. *May be repeated for credit with change of topic.*

FREN 5007. Studies in French Culture and Civilization. (3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. Major topics in French culture and civilization. *May be repeated for credit with change of topic.*

FREN 5050. Topics in French. (1 to 3) Prerequisite(s): Post-baccalaureate status; B.A. in French; ENGL 1102 or equivalent, if taught in English. Major topics in French. May be taught in French or English. Will not count toward the major if taught in English. *May be repeated for credit with change of topic.*

FREN 5201. Survey of French Literature I. (3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. The major literary movements from the Middle Ages to the Enlightenment, with sample texts. Emphasis on continuity and change.

FREN 5202. Survey of French Literature II. (3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. The major literary movements from the Enlightenment to the contemporary period, with sample texts. Emphasis on continuity and change.

FREN 5410. Professional Internship in French. (1 to 6) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. Faculty-supervised field and/or research experience in a cooperating profession (e.g., business) or community organization. Contents of internship based upon a contractual agreement among the student, department, and business or community organization. *Graded on a Pass/Unsatisfactory basis.*

FREN 5800. Directed Individual Study. (1 to 3) Prerequisite(s): Post-baccalaureate status, B.A. in French, or permission of department. Individual work on a selected area of study. To be arranged with the instructor, generally during the preceding semester, and by special permission only. *May be repeated for credit.*

Geography (GEOG)

GEOG 5000. Topics in Geography. (3) Major topics in Geography. *May be repeated for credit with change of topic.*

GEOG 5040. Transportation Topics. (3) Prerequisite(s): Permission of department. Investigation of special topics in transportation including: transit systems, mobility and travel patterns, land use/transportation interface, air pollution, and information systems.

GEOG 5101. Cartographic Techniques. (3) Prerequisite(s): GEOG 2100. Preparation of maps, figures, and charts at a professional level of competence. Techniques emphasized include: desktop mapping with computers, high-resolution image setting output, color separation techniques, which include computer separations as well as scribing and various related photographic processes. Two laboratories of three hours each per week.

GEOG 5102. Cartographic Design and Map Construction. (3) Design process and basic map construction techniques with particular emphasis on the graphic elements of map design, planning map design, creating visual hierarchies, the uses of color, and basic mechanical color separation.

GEOG 5103. Computer Programming for GIS Applications. (3) Cross-listed Course(s): GEOG 4103. Prerequisite(s): GEOG 6125. Automated methods of gathering, storing, manipulating and displaying spatial data. Emphasis on the use of existing software and the design and implementation of geographic data structures and algorithms.

GEOG 5108. Sport, Place, and Development. (3) Prerequisite(s): GEOG 1105. Examines sport and its impact on the landscape of cities and communities. Implications of sport are examined in terms of urban use, urban social structure, markets, franchise movement and expansion, urban politics, its role in defining sense of place, and its impact on the development of communities and regions.

GEOG 5110. GIS for Nonmajors. (3) Examines the fundamental concepts and techniques of Geographic Information System (GIS) technology and its application to social and physical sciences. Students learn processing, collecting, organizing, displaying, and analyzing geographic data from address geocoding, GPS, CD-ROM, World Wide Web, and other sources. Emphasis placed on data preparation, analysis, and presentation. Labs introduce students to ArcGIS.

GEOG 5120. Introduction to Geographic Information Systems. (4) Prerequisite(s): Permission of instructor. Development, current state-of-the-art and future trends in geographic information processing with emphasis on data gathering, storage, and retrieval, analytical capabilities and display technologies. A laboratory component will include development and completion of an applied GIS research project. Additional requirements for graduate credit. Three lecture hours, one two-hour lab per week.

GEOG 5130. Advanced Geographic Information Systems. (4) Prerequisite(s): GEOG 5120 or permission of instructor. Advanced GIS study with emphasis on (1) advanced skills for database development and management; (2) spatial analysis and modeling; and (3) Macro language programming and user interface design. Three lecture hours and a two-hour lab session each week.

GEOG 5131. Environmental Modeling with GIS. (4) Prerequisite(s): GEOG 5120 or permission of instructor. Theories and practices of modeling the environment with GIS. Topics include: types of spatial modeling frameworks; GIS data sources and measurement technologies for environmental modeling; development, calibration, and validation of environmental models; 3-dimensional modeling and visualization of physical processes; and spatial analysis of human-environment interactions.

GEOG 5132. Spatial Modeling for Social and Economical Applications. (3) Theories and practices of spatial modeling with social and economical applications. Topics include: overview of modeling in human geography, socioeconomic data sources, and building and evaluating spatial models. Examples of models covered in class include: spatial accessibility, interaction, diffusion, tipping points, segregation (simulation), geodemographic/ segmentation, and Markov models (stochastic).

GEOG 5150. Spatial Database Development with GPS and GIS. (3) The fundamentals of database management systems and their relevance in GIS. Emphasis placed on the effective creation, maintenance, and retrieval or data from a spatially enabled database. Topics include: relational database theory and design, entity-relationship diagrams, Structured Query Language (SQL), spatial queries, geodatabase design.

GEOG 5155. Retail Location. (3) Spatial attributes of retailing and related activities. Location patterns, store location research, trade area delineation and consumer spatial behavior.

GEOG 5160. The Geography of Transportation Systems. (3) Geographical and human factors that affect the movement of goods and people from place to place. Emphasis on transportation routes and networks, commodity flow patterns and the locational implications of freight rates.

GEOG 5180. Web GIS. (3) Cross-listed Course(s): GEOG 4180. Prerequisite(s): GEOG 6125. Introduction to the basic knowledge of, and advance in, Internet/Web GIS. It covers principles, methods, and applications of Web- or Internet-based GIS. Through hands-on laboratory exercises, students develop the skill necessary to use Web GIS software packages for conducting GIS data operations (including query and mapping) and spatial analysis/modeling via Internet.

GEOG 5209. Small Town Planning. (3) Explores small town population dynamics, rural-urban fringe land use dynamics, and changes in small towns' community identity and sense of place. Emphasis placed on the issues and techniques that typify small town planning environments. Students investigate these issues via field work and data collection at municipal scales within the Charlotte region.

GEOG 5210. Urban Planning Methods. (3) Scope and methods of urban planning. Emphasis on analytical techniques, projections, and data sources used in developing comprehensive planning tasks and strategies.

GEOG 5215. Urban Ecology. (3) An introduction to the emerging field of urban ecology. Explores the biological, physical, and social components of the urban ecosystem at local, regional, and global scales. Emphasis on the interplay among components and the sustainability of cities during lectures, field trips, and group discussions.

GEOG 5240. Geography of Knowledge and Information. (3) Examination of the factors that influence the location of economic activities in the information age. Discussions and lectures explore the geographic aspects of the transition away from manufacturing to information processing as the primary mode of production. The transition is examined in terms of technology development, urban and regional development, information flows, and the location of quaternary industry.

GEOG 5250. Food, Migration, and Place. (3) Cross-listed Course(s): GEOG 4250. As people move in the world, food plays a central role in shaping identity, reproducing myth and ritual, and connecting diasporic communities. This mobility establishes dynamic foodways and gives rise to new food landscapes through which we can understand temporally connected sites of intense interaction. This course unpacks these processes through investigating the dynamics of food production and consumption in a transnational world. Recognizing the centrality of culinary culture in migrant identities, this course focuses on the role of food habits, rituals, and practices in producing and sustaining shared identities and places. Students gain an understanding of these relations through engagement with case studies and literature addressing the complex spaces we inhabit in a transnational world.

GEOG 5255. Applied Population Analysis. (3) Population data sources; measuring population change; elementary projection and estimation techniques; spatial sampling; migration; survey design; applications in the public and private sectors.

GEOG 5260. Transportation Policy Formulation. (3) Prerequisite(s): Permission of department. Structure of transportation policy at federal, state, and local levels including policies concerning highway financing and investments, congestion, safety, and use and development, energy, transit, and the provision of intercity services.

GEOG 5265. Transportation Analysis Methods. (3) Prerequisite(s): Permission of department; statistics recommended. Procedures for analyzing the operation and performance of transportation systems; includes network planning models, minimum path algorithms and assignments; energy, air pollution, and activity analysis models; and research approaches, data sources, time and activity budgets, infrastructure condition and needs assessment.

GEOG 5310. Urban Social Geography. (3) Prerequisite(s): GEOG 1105 and at least one of GEOG 2200, GEOG 2165, GEOG 3100, or GEOG 3205, or permission of instructor. Examines the reflexive relationship between society and urban space. Explores the intersection between urban geography and social theory, the evolution of city, community and personal spaces, and the relations and constructions of class, race, gender, and sexuality that shape and are shaped by the urban spaces in which we live and work.

GEOG 5405. Urban Field Geography. (6) Prerequisite(s): six hours of urban-related undergraduate courses or permission of instructor. Intensive field studies of cities of the Carolinas, including one-day and overnight trips to cities of the mountains and coastal areas. Emphasis on day study trips within the Piedmont. Exercises include land-use mapping, trip journals, interviews and comparisons of the results of zoning and urban development practices within satellite cities of the Charlotte Metropolitan Statistical Area.

GEOG 6000. Topics in Urban and Regional Analysis. (3) Cross-listed Course(s): GEOG 8000. Examination of major theories, methods, and issues in the area of urban and regional analysis. Instructional method(s) vary according to topic, course objectives, and instructor. *May be repeated for credit with change of topic.*

GEOG 6005. Topics in Earth and Environmental Systems. (3) Cross-listed Course(s): GEOG 8005. Emerging methods and research frontiers in Earth and Environmental

Systems. Course format includes lectures, student-led group discussions of readings, and/or hands-on data collection and analysis in the field or using available datasets. *May be repeated for credit with change of topic.*

GEOG 6010. Topics in Geographic Information Science. (3) Cross-listed Course(s): GEOG 8010. Examination of major theories, methods, and issues in the area of Geographic Information Science. Instructional method(s) vary according to topic, course objectives, and instructor. *May be repeated for credit with change of topic.*

GEOG 6015. Topics in Regional Geography. (3) Intensive examination of major spatial questions in a given region. *May be repeated for credit with change of topic.*

GEOG 6030. Topics in Geographic Techniques. (3) Cross-listed Course(s): GEOG 8030. Cartographic, remote sensing, quantitative techniques or field techniques. *May be repeated for credit with change of topic.*

GEOG 6103. Real Estate Development. (3) Cross-listed Course(s): MBAD 6159 and MSRE 6159. An introduction to the real estate development process. Identification and evaluation of the critical assumptions and issues related to market and site feasibility, financial feasibility, planning, acquisition, and operation of economically viable commercial real estate projects. Students work in groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

GEOG 6105. Applied Real Estate Development. (3) Cross-listed Course(s): MBAD 6259 and MSRE 6259. Prerequisite(s): MBAD 6159 or GEOG 6103. The application of the processes involved in real estate development. Students work in groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

GEOG 6115. Qualitative Methods in Geography. (3) Cross-listed Course(s): GEOG 8115. Prerequisite(s): GRAD 6101 or equivalent. An overview of qualitative research methods commonly used in the geosciences. In addition to reviewing the evolution and theoretical underpinnings of qualitative approaches in the field of Geography generally, the course explores the application and evaluation of various methodologies such as, but not limited to, interviews, focus groups, discourse analysis and participatory research. Issues of research design, rigor, ethics, and communication of qualitative methods are also addressed.

GEOG 6120. Spatial Statistics. (3) Cross-listed Course(s): GEOG 8120, GRAD 6104, GRAD 8104, and INES 8090. Introduction to modern spatial statistics methods and their applications for the analysis of spatial data. Fundamental characteristics of spatial data, including spatial dependence, stationarity, and isostropy are covered. Three main categories of spatial statistics are given focus: spatial point pattern analysis, spatial prediction and geostatistics, and spatial regression. Hands-on practices are given to facilitate the understanding of theories and methods of spatial statistics.

GEOG 6121. Advanced Seminar on Spatial Modeling. (3) Cross-listed Course(s): GEOG 8121. Prerequisite(s): GEOG 5131, GEOG 5132, or permission of instructor. This seminar focuses on the theories of spatial modeling and simulation. Topics include, but are not limited to, spatial systems, models for spatial analysis, models for spatial simulation, modeling life-cycle, model verification, validation, and accreditation.

GEOG 6123. The Urban Region. (3) Cross-listed Course(s): GEOG 8123 and PPOL 8610. Examination of the nature of urban regions and the basic factors that shape urban regions as they grow. Impact of: geography; history; social factors; economic factors; concerns about gender, race and ethnicity, and class; and other determinants of the nature of urban regions, their problems, and possible policy solutions.

GEOG 6124. Seminar in Geographic Theory and Practice. (3) Cross-listed Course(s): GEOG 8124. Prerequisite(s): Permission of instructor. Critical examination of trends in the history and philosophy of geographic thought and their application across the human, physical, and methodological domains of the discipline.

GEOG 6125. Geographic Information Science and Technology. (4) Cross-listed Course(s): GEOG 8125. Development, current state-of-the-art and future trends in geographic information science and technology. Topics include: Nature of spatial data, scale, representation, projection, topological relationships, data acquisition (geocoding, GPS, Volunteered Geographic Information), data uncertainty, data organization (spatial database), spatial data manipulation and protection (geomasking, aggregation), overlay operations (including spatial join), network analysis, raster and terrain modeling, spatial autocorrelation (global and local), spatial interpolation, spatial and space-time clustering. Concepts of cartographic design are introduced throughout the class. Several applications and laboratory exercises illustrate the concepts set forth in the class.

GEOG 6131. Research Design Fundamentals. (3) Cross-listed Course(s): GEOG 8131. Prerequisite(s): GRAD 6101 or equivalent; and permission of instructor. Scientific research and problem-solving. Problem identification, bibliographic search, data sources, collection and management,

techniques selection and preparation of reports, proposals, peer review, and publication. Topics also include: human subjects and societal impacts of research, conflict of interest, collaboration, mentorship, and research misconduct.

GEOG 6132. Seminar in Geography. (3) Study of the current trends in geographic thought and research methods. *Graded on a Pass/Unsatisfactory basis.*

GEOG 6182. Agent-Based Modeling of Coupled Human and Natural Systems. (3) Prerequisite(s): GEOG 6125. Introduces an advanced geocomputational approach, agent-based models (ABM, also often referred to as individual based models: IBM), for the simulation of complex adaptive spatial systems in general and coupled human and natural systems, in particular. Covers fundamental theories (e.g., complexity theory and simulation theory), methods (including model design, development, calibration, and validation), and applications (e.g., in natural and social sciences) of ABM/IBM. Focuses on the integration of GIS (Geographic Information Systems) with ABM/IBM that enables the space-time studies of complex geographic phenomena. Hands-on practices are given to facilitate the understanding of modeling theories and methods.

GEOG 6205. Geovisualization. (3) Cross-listed Course(s): GEOG 8205. Prerequisite(s): GEOG 6125. Cartographic design, representation versus communication, cognitive and perceptual issues, visual variables and color, proportional symbology, choropleth and flow mapping. Exploratory space-time data analysis. Representation of change (space-time) and movement. Interactive, dynamic and animated visualization. 3D geovisualization. Series of exercises in a GIS environment.

GEOG 6208. GIS&T and Urban Regional Analysis. (3) Cross-listed Course(s): GEOG 8208. Prerequisite(s): Permission of instructor. Focuses on the spatial thinking, spatial analytic methods and their GIS applications suited for urban and regional analyses. Modeling approaches include spatial interaction models, spatial optimization methods, spatial diffusion, space-time modeling of individual behavior and integrated transportation land-use models.

GEOG 6209. Social Network Analysis. (3) Cross-listed Course(s): GEOG 8209. Prerequisite(s): GRAD 6101 or equivalent. Pre- or Corequisite(s): GRAD 6101. Focuses on the use of social network analysis to understand the expanding connectivity and complexity of the socioeconomic world at all scales, and to systemically study semantic relationships and emerging social structures, whether they are social organizations, companies, virtual or place-based communities, markets, or politically-defined entities. Discusses how social network concepts, theories, and methods frame a wide range of phenomena within the context of relevant social science theories. Emphasis is placed on applied methods and on developing skills useful in empirical social science research.

GEOG 6210. The Restructuring City. (3) Cross-listed Course(s): GEOG 8210 and PPOL 8615. Critical assessment of the causes and consequences of contemporary urban restructuring. Evaluation of theoretical, planning and policy challenges facing urban society associated with global-local change.

GEOG 6211. Cities and Immigrants. (3) Cross-listed Course(s): GEOG 8211. Prerequisite(s): Permission of instructor. Examination of changing patterns and dynamics of immigrant settlement and adjustment in U.S. and Canadian urban areas. Topics include: assimilation and integration, identity formation, trans-nationalism, enclave development, labor market involvement, gateway versus new destinations, immigrant suburbanization, and socio-spatial isolation.

GEOG 6212. Urban Labor Markets. (3) Cross-listed Course(s): GEOG 8212. Prerequisite(s): Permission of instructor. Explores the changing social and spatial structure of urban labor markets in post-industrialized cities. Special reference to immigrant and minority labor markets in the U.S. Topics include: discrimination, industry and occupation concentrations, job queues, ethnic networks, ethnic entrepreneurs, technological change and economic restructuring.

GEOG 6214. Resilience Thinking in Urban/Regional Socio-Ecological Systems. (3) Cross-listed Course(s): GEOG 8214. Examines critically the art and science of resilience thinking within the context of urban and regional socio-ecological systems (i.e., urban resilience) and explores resilience building as both an instrument for, and practice of, urban sustainable development.

GEOG 6215. Urban Identities: Explorations of Power, Inequality, and Identity in Contemporary Cities. (3) Cross-listed Course(s): GEOG 8215. Contemporary cities are idealized as cosmopolitan places inhabited by residents of different genders, ethnicities, sexualities, classes, and other identities. Yet each of these intersecting axes of difference contribute to varied experiences, struggles, and uses of urban space. This course examines the production and maintenance of relations of power, inequality, and identity in contemporary cities. Critical frameworks in feminist, critical race, sexuality, post-colonial, and intersectional theory are used to consider the ways that intersecting power relations are spatialized and embodied, shape perceptions and understanding of space and place, and contribute to struggles for the right to the city. Such frameworks are applied to urban processes and problems

relating to economic restructuring, housing, poverty, public space, and social movements.

GEOG 6216. Planning for Urban Sustainability. (3) Cross-listed Course(s): GEOG 8216. Engages students in reading, discussion, and guided research on the dilemmas of urban sustainability and planning approaches to address these dilemmas. Examines the concept of sustainability critically, comparing its diverse applications and meanings as a guide for decisions in the built environment. Explores the social and physical structures that make radical change difficult, as well as innovations in city planning like ecological footprinting, climate action planning, smart growth, bus rapid transit, energy-efficient technologies, the sharing economy, and grassroots movements for alternative communities like ecovillages. Although the course engages scholarship from all over the world, and explores innovations in Latin American and some European cities, most of the discussion focuses on problems and solutions specific to the United States.

GEOG 6220. Human-Environment Interactions. (3) Cross-listed Course(s): GEOG 8220. Prerequisite(s): Permission of instructor. Investigates the inter-relationships between humans and their natural or physical environments. Topics include: human subsistence strategies, natural resource use, and human impact upon vegetation, soil, water, landforms, and climate.

GEOG 6221. Global Ecosystems. (3) Cross-listed Course(s): GEOG 8221. A multi-disciplinary course which surveys the history and prehistory of human ecological dynamics, drawing on geology, geography, and ecology to understand the interrelationships between global environmental systems and their inhabitants. Topics include: climatic change and its impacts on biological systems, peopling of new landscapes, anthropogenic vegetation change, extinctions, desertification, invasive species interactions, and changes in human subsistence.

GEOG 6222. Quaternary Paleoenvironmental Sciences. (3) Cross-listed Course(s): ESCI 6222, GEOG 8222, and INES 8222. A multi-disciplinary course which surveys methods used to reconstruct past climates, past environments and past landscapes during the Quaternary period. Changes in past environmental conditions are discussed in light of present and future landscape predictions emphasizing both natural and human causes. Focuses on biotic and abiotic material from terrestrial and marine sediment cores, ice cores, and other proxies for past environments and past climates.

GEOG 6225. Biogeography. (3) Cross-listed Course(s): GEOG 8225. Prerequisite(s): Permission of instructor. Introduction to the field of biogeography, the study of the distribution of organisms across space and time. Foundational theories and principles in biogeography, as well as emerging research frontiers, are covered in lectures and student-led group discussions of weekly readings.

GEOG 6226. Landscape Ecology. (3) Cross-listed Course(s): ESCI 6226, GEOG 8226, and INES 8226. An introduction to landscape ecology, the study of the interplay between spatial pattern and ecological process. Lectures and in-depth group discussions focus on the fundamental and applied aspects of topics such as habitat fragmentation, animal movement in human-dominated landscapes, landscape legacies, road ecology, and landscape planning.

GEOG 6227. Ecosystem Restoration. (3) Cross-listed Course(s): ESCI 6227, GEOG 8227, and INES 8227. Ecosystem restoration has long been used as a method to return the natural structure and function to degraded ecosystems. This course examines the theory and methods used in restoration with a focus on both terrestrial and freshwater ecosystems. Focuses on the science and policy of ecosystem restoration with examples from ecosystems around the world.

GEOG 6229. Geochemical Tracers and Hydrologic Applications. (3) Cross-listed Course(s): ESCI 6229, GEOG 8229, and INES 8229. Examines environmental tracers in surface and subsurface hydrology (streams, lakes, and groundwater) using an applied approach. Tracer techniques include geochemical element fingerprinting, stable isotopes, and residence time estimation.

GEOG 6282. CyberGIS and Big Data. (3) Cross-listed Course(s): GEOG 8282. Prerequisite(s): GEOG 6125. CyberGIS and Big Data represent two emerging themes in the study of geographic information science. As geospatial technologies advance, big spatial data are increasingly available. However, the processing and analytics of these big spatial data represent a challenge. Cyberinfrastructure-enabled GIS (i.e., CyberGIS) provides solid support for resolving this challenge. The significance of CyberGIS in handling big spatial data analytics has been well recognized. This course focuses on the key capabilities of CyberGIS: high-performance and parallel spatial computing, spatial cloud computing, and big data analytics. It also exposes students to cutting-edge cyberinfrastructure theories, methods, and geospatial applications. Students benefit from this course by learning how to leverage state-of-the-art cyberinfrastructure-enabled GIS technologies for the resolution of complex spatiotemporal problems. With training from cyber-enabled GIS and big data, students are very productive in their specific domains and competitive in their future career.

GEOG 6300. Applied Regional Analysis. (3) Cross-listed Course(s): GEOG 8300. Prerequisite(s): Basic computer

skills including spreadsheets. Introduction to methods and techniques used in regional analysis. Topical areas include data sources and collection, regional delineation, community and regional profiles, regional accounts, methods of analysis and impact assessment. Topics are discussed in terms of theory, use, and role in economic geography and regional development. Emphasis is placed on application of economic and demographic methods at the regional level.

GEOG 6301. Industrial Location. (3) Cross-listed Course(s): GEOG 8301. Addresses factors influencing the location of industrial and service activities. Classical theories of industrial location are augmented with contemporary interpretations of the economic landscape. Emphasis is placed on theoretical foundations and new developments in industrial location theory, patterns and trends of industrial location, the site selection process, community impacts of locational decision-making, and the role of governments. Patterns and trends are examined in regional, national, and international perspectives.

GEOG 6302. Regional Economic Development. (3) Cross-listed Course(s): GEOG 8302 and PPOL 8642. Neo-classical and contemporary theories of trade, economic geography and urban and regional development. Topics include: theories of urban and regional growth, location theories including industry, central places, and growth centers; human capital, labor force, and entrepreneurial contributions to growth; policy dimensions of urban growth and development are addressed from theoretical and empirical perspectives.

GEOG 6304. The Transforming North Carolina Economy. (3) Cross-listed Course(s): GEOG 8304. Prerequisite(s): Permission of instructor. An examination of the contemporary and historic forces which shape the economic geography of the state. Themes examined will include human-land interactions, past and present economic transitions and the rural-urban balance within the state. Emphasis will be placed on understanding the economic forces which will most dramatically impact the future. Seminar format.

GEOG 6305. Site Feasibility Analysis. (3) Cross-listed Course(s): MBAD 6258 and MSRE 6258. Prerequisite(s): Permission of instructor. Examination of factors affecting the feasibility of land parcels for commercial and residential development with emphasis on the physical evaluation of a given site, the market support for its intended use, and the financial support for the proposed development.

GEOG 6306. Store Location Research. (3) Prerequisite(s): GRAD 6101 or permission of instructor. Market area analysis and site evaluation methods, including the application of multivariate statistical models, spatial interaction-gravity models, and location-allocation techniques to the retail location analysis task.

GEOG 6400. Advanced Seminar in Spatial Decision Support Systems (SDSS). (4) Prerequisite(s): GEOG 5120 or permission of instructor. Theoretical aspects of spatial DSS including technical, social, political and psychological consideration; systems design; systems manipulation; and case studies. Three hours of lecture and one two-hour lab per week.

GEOG 6401. GIS Programming and Customization. (3) Cross-listed Course(s): GEOG 8401. Prerequisite(s): GEOG 4120/5120 or permission of instructor. This course consists of tutorials, readings, projects, and discussions of how to customize and to program ArcObjects within various programming environments: to program automatic repetitive tasks, to build their own applications, to write geoprocessing scripts, and to develop and customize the Web applications.

GEOG 6402. Multi-Attribute Assessment/Evaluation for Planning and Decision-Making. (3) Prerequisite(s): Permission of instructor. A survey and comparison of multi-attribute assessment and evaluation methods in spatial planning and decision-making; and discusses the implementation of these methods with the aid of geographic information techniques. Topics include: land suitability/vulnerability assessment, environmental and social impact assessment, risk assessment, site selection, plan evaluation, and multi-criteria decision analysis.

GEOG 6404. Spatial Data Analysis in GIS. (3) Prerequisite(s): GEOG 5120 or permission of instructor. Advanced analytical methods used in GIS and spatial data analysis to advance the understanding of spatial patterns and to invoke powerful principles of spatial thinking. Examination of theoretical and conceptual aspects of algorithms used in GIS software to analyze spatial data. Critical assessment of the use, misuse, abuse and limitations of GIS analytical techniques.

GEOG 6405. Three Dimensional Visualization. (3) Prerequisite(s): GEOG 4130/5130 or permission of instructor. This course consists of tutorials, readings, projects, and discussions concerned with how geo-visualization techniques can be used to display geographic information driven from spatial analyses in 3D GIS. Students who successfully complete the course are able to understand advanced geographic information systems, focusing on multi-dimensional data models and three-dimensional geo-visualization as spatial analyses tools. In addition, students work on independent and group projects to develop 3D GIS applications such as 3D Urban Simulation System using existing 3D GIS and visualization software.

GEOG 6406. Spatial Information and Mobility. (4). Prerequisite(s): GEOG 5120 or permission of instructor. Issues related to the collection, storage, and dissemination of data and information used in transportation analysis, planning, and operations. Students are exposed to the functionality of geographic information systems and concepts of Geographic Information Science that enable these tasks, as well as to traditional travel data collection techniques. Advanced data collection and information dissemination approaches are also discussed, including the use of probes, sensors, GPS, and other wireless communication devices. The fundamentals of Intelligent Transportation Systems form a central part of the course. Finally, the state-of-the-art and future of location-based services and telematics systems is discussed from the perspective of personal mobility and spatial information.

GEOG 6407. Geocomputation. (3) Cross-listed Course(s): GEOG 8407. Prerequisite(s): GEOG 5120 or permission of instructor. The implementation of computational techniques and resources for the exploration and analysis of (large) spatially referenced databases. Provides an assessment of the place and contribution of computational methods in spatial data handling. Explores "new" computationally intensive approaches to doing geography. Topics include: artificial neural networks, machine learning induction algorithms, genetic and other evolutionary algorithms, and other algorithms for spatial data mining.

GEOG 6408. Spatial Optimization. (3) Cross-listed Course(s): GEOG 8408. Prerequisite(s): GEOG 5120 or permission of instructor. Spatial Optimization is articulated around the explicit use of GIS tools and techniques to solve coverage, distance-decay problems as well as routing problems integrating geographic information. Case studies in various domains such as urban retailing or transportation. Problem formulation and solution techniques to optimally preserve existing natural reserves, such as reservoir resources or locating natural corridors between biologically rich areas to protect diversity.

GEOG 6500. Urban Planning: Theory and Practice. (3) Cross-listed Course(s): GEOG 8500 and PPOL 8616. Critical assessment of alternative planning theories and their application to planning practices. Examination of economic, political, social, cultural and geographical factors affecting the operations of cities and resource distribution.

GEOG 6501. Community Planning Workshop. (3) Cross-listed Course(s): ARCH 6050 and MUDD 5601. Problem-solving, client-based course designed to give students experience in applying planning theory and methods to actual problems. Types of problems include growth management, land use planning, regional planning, community development, urban design, infrastructure financing, economic development, and environmental management. Students will gain experience compiling and analyzing community scale data, working with citizens, professional planners, and elected officials and preparing oral reports and technical documents. The workshop setting will build upon and extend conventional classroom instructions.

GEOG 6600. Transportation Policy. (3) Cross-listed Course(s): GEOG 8600 and PPOL 8613. Examination of surface transportation from a public policy perspective. Institutional components and role of government at all levels influencing investment; changes in technology, environment, security, safety, equity, cost-effectiveness, public health and welfare are covered.

GEOG 6612. Advanced Geography of Transportation Systems. (3) Cross-listed Course(s): GEOG 8612. Prerequisite(s): GRAD 6101, GRAD 8101, or permission of instructor. Exploration of transportation systems from a geographic perspective. The course emphasizes the importance of these systems in the past, present and future. The course explores the relationships between the organization of the space economy and transportation, the flow of people, commodity and ideas at different scales of observation from the small picture (urban transportation) to the big, global picture (international transportation), mobility issues in everyday life and in the economy. The social, economic, physical, and political contexts of transportation systems are discussed. The course is also designed to develop analytical capabilities by using a few fundamental techniques of transportation planning and analysis.

GEOG 6643. Rural Development Issues. (3) Prerequisite(s): Permission of instructor. This course provides research experiences that focus on policy formulation, and demographic, economic and planning issues in rural areas.

GEOG 6800. Directed Problems in Geography. (1 to 4) Cross-listed Course(s): GEOG 8800. Individual research into geographic topics. *May be repeated for credit one time with change of topic.*

GEOG 7900. Individual Research Project. (1 to 6) Individual research report based on directed study of a topic of geographic significance. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit (required minimum total of 6 credits).*

GEOG 8000. Topics in Urban and Regional Analysis. (3) Cross-listed Course(s): GEOG 6000. Examination of major theories, methods, and issues in the area of urban and regional analysis. Instructional method(s) vary according to topic, course objectives, and instructor. *May be repeated for credit with change of topic.*

GEOG 8005. Topics in Earth and Environmental Systems. (3 to 4) Cross-listed Course(s): GEOG 6005. Emerging methods and research frontiers in Earth and Environmental Systems. Course format includes lectures, student-led group discussions of readings, and/or hands-on data collection and analysis in the field or using available datasets. *May be repeated for credit with change of topic.*

GEOG 8010. Topics in Geographic Information Science. (3) Cross-listed Course(s): GEOG 6010. Examination of major theories, methods and issues in the area of Geographic Information Science. Instructional method(s) vary according to topic, course objectives and instructor. *May be repeated for credit with change of topic.*

GEOG 8030. Topics in Geographic Techniques. (3) Cross-listed Course(s): GEOG 6030. Cartographic, remote sensing, quantitative techniques or field techniques. *May be repeated for credit with change of topic.*

GEOG 8115. Qualitative Methods in Geography. (3) Cross-listed Course(s): GEOG 6115. Prerequisite(s): GRAD 8101 or equivalent, or permission of instructor. An overview of qualitative research methods commonly used in the geosciences. In addition to reviewing the evolution and theoretical underpinnings of qualitative approaches in the field of Geography generally, the course explores the application and evaluation of various methodologies such as, but not limited to, interviews, focus groups, discourse analysis and participatory research. Issues of research design, rigor, ethics, and communication of qualitative methods are also addressed.

GEOG 8120. Spatial Statistics. (3) Cross-listed Course(s): GEOG 6120, GRAD 6104, GRAD 8104, and INES 8090. Prerequisite(s): GRAD 8101 or equivalent. Introduction to modern spatial statistics methods and their applications for the analysis of spatial data. Fundamental characteristics of spatial data, including spatial dependence, stationarity, and isostropy are covered. Three main categories of spatial statistics are given focus: spatial point pattern analysis, spatial prediction and geostatistics, and spatial regression. Hands-on practices are given to facilitate the understanding of theories and methods of spatial statistics.

GEOG 8121. Advanced Seminar on Spatial Modeling. (3) Cross-listed Course(s): GEOG 6121. Prerequisite(s): GEOG 5131, GEOG 5132, or permission of instructor. This seminar focuses on the theories of spatial modeling and simulation. Topics include, but are not limited to, spatial systems, models for spatial analysis, models for spatial simulation, modeling life-cycle, model verification, validation, and accreditation.

GEOG 8123. The Urban Region. (3) Cross-listed Course(s): GEOG 6123 and PPOL 8610. Examination of the nature of urban regions and the basic factors that shape urban regions as they grow. Impact of: geography; history; social factors; economic factors; concerns about gender, race and ethnicity, and class; and other determinants of the nature of urban regions, their problems, and possible policy solutions.

GEOG 8124. Seminar in Geographic Theory and Practice. (3) Cross-listed Course(s): GEOG 6124. Prerequisite(s): Permission of instructor. Critical examination of trends in the history and philosophy of geographic thought and their application across the human, physical, and methodological domains of the discipline.

GEOG 8125. Geographic Information Science and Technology. (4) Cross-listed Course(s): GEOG 6125. Development, current state-of-the-art and future trends in geographic information science and technology. Topics include: Nature of spatial data, scale, representation, projection, topological relationships, data acquisition (geocoding, GPS, Volunteered Geographic Information), data uncertainty, data organization (spatial database), spatial data manipulation and protection (geomasking, aggregation), overlay operations (including spatial join), network analysis, raster and terrain modeling, spatial autocorrelation (global and local), spatial interpolation, spatial and space-time clustering. Concepts of cartographic design are introduced throughout the class. Several applications and laboratory exercises illustrate the concepts set forth in the class.

GEOG 8131. Research Design Fundamentals. (3) Cross-listed Course(s): GEOG 6131. Prerequisite(s): GRAD 8101 or equivalent; and permission of instructor. Scientific research and problem-solving. Problem identification, bibliographic search, data sources, collection and management, techniques selection and preparation of reports, proposals, peer review. and publication. Topics also include: human subjects and societal impacts of research, conflict of interest, collaboration, mentorship, and research misconduct.

GEOG 8205. Geovisualization. (3) Cross-listed Course(s): GEOG 6205. Prerequisite(s): GEOG 8125. Cartographic design, representation versus communication, cognitive and perceptual issues, visual variables and color, proportional symbology, choropleth and flow mapping. Exploratory space-time data analysis. Representation of change (space-time) and movement. Interactive, dynamic and animated visualization. 3D geovisualization. Series of exercises in a GIS environment.

GEOG 8208. GIS&T and Urban Regional Analysis. (3) Cross-listed Course(s): GEOG 6208. Prerequisite(s): Permission of instructor. Focuses on the spatial thinking, spatial analytic methods and their GIS applications suited for urban and regional analyses. Modeling approaches

include spatial interaction models, spatial optimization methods, spatial diffusion, space-time modeling of individual behavior and integrated transportation land-use models.

GEOG 8209. Social Network Analysis. (3) Cross-listed Course(s): GEOG 6209. Prerequisite(s): GRAD 6101 or equivalent. Pre- or Corequisite(s): GRAD 6101. Focuses on the use of social network analysis to understand the expanding connectivity and complexity of the socioeconomic world at all scales, and to systemically study semantic relationships and emerging social structures, whether they are social organizations, companies, virtual or place-based communities, markets, or politically-defined entities. Discusses how social network concepts, theories, and methods frame a wide range of phenomena within the context of releva

GEOG 8210. The Restructuring City. (3) Cross-listed Course(s): GEOG 6210 and PPOL 8615. Critical assessment of the causes and consequences of contemporary urban restructuring. Evaluation of theoretical, planning and policy challenges facing urban society associated with global-local change.

GEOG 8211. Cities and Immigrants. (3) Cross-listed Course(s): GEOG 6211. Prerequisite(s): Permission of instructor. Examination of changing patterns and dynamics of immigrant settlement and adjustment in U.S. and Canadian urban areas. Topical areas include assimilation and integration, identity formation, trans-nationalism, enclave development, labor market involvement, gateway versus new destinations, immigrant suburbanization and socio-spatial isolation.

GEOG 8212. Urban Labor Markets. (3) Cross-listed Course(s): GEOG 6212. Prerequisite(s): Permission of instructor. Explores the changing social and spatial structure of urban labor markets in post-industrialized cities. Special reference to immigrant and minority labor markets in the U.S. Topics include: discrimination, industry and occupation concentrations, job queues, ethnic networks, ethnic entrepreneurs, technological change and economic restructuring.

GEOG 8214. Resilience Thinking in Urban/Regional Socio-Ecological Systems. (3) Cross-listed Course(s): GEOG 6214. Examines critically the art and science of resilience thinking within the context of urban and regional socio-ecological systems (i.e., urban resilience) and explores resilience building as both an instrument for, and practice of, urban sustainable development.

GEOG 8215. Urban Identities: Explorations of Power, Inequality, and Identity in Contemporary Cities. (3) Cross-listed Course(s): GEOG 6215. Contemporary cities are idealized as cosmopolitan places inhabited by residents of different genders, ethnicities, sexualities, classes, and other identities. Yet each of these intersecting axes of difference contribute to varied experiences, struggles, and uses of urban space. This course examines the production and maintenance of relations of power, inequality, and identity in contemporary cities. Critical frameworks in feminist, critical race, sexuality, post-colonial, and intersectional theory are used to consider the ways that intersecting power relations are spatialized and embodied, shape perceptions and understanding of space and place, and contribute to struggles for the right to the city. Such frameworks are applied to urban processes and problems relating to economic restructuring, housing, poverty, public space, and social movements.

GEOG 8216. Planning for Urban Sustainability. (3) Cross-listed Course(s): GEOG 6216. Engages students in reading, discussion, and guided research on the dilemmas of urban sustainability and planning approaches to address these dilemmas. Examines the concept of sustainability critically, comparing its diverse applications and meanings as a guide for decisions in the built environment. Explores the social and physical structures that make radical change difficult, as well as innovations in city planning like ecological footprinting, climate action planning, smart growth, bus rapid transit, energy-efficient technologies, the sharing economy, and grassroots movements for alternative communities like ecovillages. Although the course engages scholarship from all over the world, and explores innovations in Latin American and some European cities, most of the discussion focuses on problems and solutions specific to the United States.

GEOG 8220. Human-Environment Interactions. (3) Cross-listed Course(s): GEOG 6220. Prequisite(s): Permission of instructor. Investigates the inter-relationships between humans and their natural or physical environments. Topics include: human subsistence strategies, natural resource use, and human impact upon vegetation, soil, water, landforms, and climate.

GEOG 8221. Global Ecosystems. (3) Cross-listed Course(s): GEOG 6221. A multi-disciplinary course which surveys the history and prehistory of human ecological dynamics, drawing on geology, geography, and ecology to understand the interrelationships between global environmental systems and their inhabitants. Topics include: climatic change and its impacts on biological systems, peopling of new landscapes, anthropogenic vegetation change, extinctions, desertification, invasive species interactions, and changes in human subsistence.

GEOG 8222. Quaternary Paleoenvironmental Sciences. (3) Cross-listed Course(s): ESCI 6222, GEOG 6222, and INES 8222. A multi-disciplinary course which surveys methods used to reconstruct past climates, past environments and

past landscapes during the Quaternary period. Changes in past environmental conditions are discussed in light of present and future landscape predictions emphasizing both natural and human causes. Focuses on biotic and abiotic material from terrestrial and marine sediment cores, ice cores, and other proxies for past environments and past climates.

GEOG 8223. Landscape Assessment. (4) Cross-listed Course(s): ESCI 6105. An advanced geomorphology course that examines current climatic and/or tectonic geomorphology research topics and methods with a focus on regional or disciplinary issues that varies each offering. Using a variety of field-based quantitative and qualitative techniques such as laser surveys, GPS, trenching and/or coring, students devise and implement a research project that includes two related but separate field sites. Three hours seminar per week with three or four mandatory field trips.

GEOG 8224. Biogeochemical Cycles. (3) Cross-listed Course(s): ESCI 6202. Examines the Earth's water and major elemental cycles including those of carbon, nitrogen, sulfur, phosphorus and the major crustal elements. Uncertainties in the current state of understanding of global elemental cycles are also explored. Special emphasis is placed on how these cycles are currently being modified through human activities.

GEOG 8225. Biogeography. (3) Cross-listed Course(s): GEOG 6225. Introduction to the field of biogeography, the study of the distribution of organisms across space and time. Foundational theories and principles in biogeography, as well as emerging research frontiers, are covered in lectures and student-led group discussions of weekly readings.

GEOG 8226. Landscape Ecology. (3) Cross-listed Course(s): ESCI 6226, GEOG 6226, and INES 8226. An introduction to landscape ecology, the study of the interplay between spatial pattern and ecological process. Lectures and in-depth group discussions focus on the fundamental and applied aspects of topics such as habitat fragmentation, animal movement in human-dominated landscapes, landscape legacies, road ecology, and landscape planning.

GEOG 8227. Ecosystem Restoration. (3) Cross-listed Course(s): ESCI 6227, GEOG 6227, and INES 8227. Ecosystem restoration has long been used as a method to return the natural structure and function to degraded ecosystems. This course examines the theory and methods used in restoration with a focus on both terrestrial and freshwater ecosystems. Focuses on the science and policy of ecosystem restoration and uses examples from ecosystems around the world.

GEOG 8229. Geochemical Tracers and Hydrologic Applications. (3) Cross-listed Course(s): ESCI 6229, GEOG 6229, and INES 8229. Examines environmental tracers in surface and subsurface hydrology (streams, lakes, and groundwater) using an applied approach. Tracer techniques include geochemical element fingerprinting, stable isotopes, and residence time estimation.

GEOG 8282. CyberGIS and Big Data. (3) Cross-listed Course(s): GEOG 6282. Prerequisite(s): GEOG 8125. CyberGIS and Big Data represent two emerging themes in the study of geographic information science. As geospatial technologies advance, big spatial data are increasingly available. However, the processing and analytics of these big spatial data represent a challenge. Cyberinfrastructure-enabled GIS (i.e., CyberGIS) provides solid support for resolving this challenge. The significance of CyberGIS in handling big spatial data analytics has been well recognized. This course focuses on the key capabilities of CyberGIS: high-performance and parallel spatial computing, spatial cloud computing, and big data analytics. It also exposes students to cutting-edge cyberinfrastructure theories, methods, and geospatial applications. Students benefit from this course by learning how to leverage state-of-the-art cyberinfrastructure-enabled GIS technologies for the resolution of complex spatiotemporal problems. With training from cyber-enabled GIS and big data, students are very productive in their specific domains and competitive in their future career.

GEOG 8300. Applied Regional Analysis. (3) Cross-listed Course(s): GEOG 6300. Prerequisite(s): Basic computer skills including spreadsheets. Introduction to methods and techniques used in regional analysis. Topical areas include data sources and collection, regional delineation, community and regional profiles, regional accounts, methods of analysis and impact assessment. Topics are discussed in terms of theory, use, and role in economic geography and regional development. Emphasis is placed on application of economic and demographic methods at the regional level.

GEOG 8301. Industrial Location. (3) Cross-listed Course(s): GEOG 6301. Addresses factors influencing the location of industrial and service activities. Classical theories of industrial location are augmented with contemporary interpretations of the economic landscape. Emphasis is placed on theoretical foundations and new developments in industrial location theory, patterns and trends of industrial location, the site selection process, community impacts of locational decision-making, and the role of governments. Patterns and trends are examined in regional, national, and international perspectives.

GEOG 8302. Regional Economic Development. (3) Cross-listed Course(s): GEOG 6302 and PPOL 8642. Neo-

classical and contemporary theories of trade, economic geography and urban and regional development. Topics include: theories of urban and regional growth, location theories including industry, central places and growth centers; human capital, labor force and entrepreneurial contributions to growth; policy dimensions of urban growth and development are addressed from theoretical and empirical perspectives.

GEOG 8304. The Transforming North Carolina Economy. (3) Cross-listed Course(s): GEOG 6304. Prerequisite(s): Permission of instructor. An examination of the contemporary and historic forces which shape the economic geography of the state. Themes examined will include human-land interactions, past and present economic transitions and the rural-urban balance within the state. Emphasis on understanding the economic forces which will most dramatically impact the future. Seminar format.

GEOG 8401. GIS Programming and Customization. (3) Cross-listed Course(s): GEOG 6401. Prerequisite(s): GEOG 4120/5120 or permission of instructor. This course consists of tutorials, readings, projects, and discussions of how to customize and to program ArcObjects within various programming environments: to program automatic repetitive tasks, to build their own applications, to write geoprocessing scripts, and to develop and customize the Web applications.

GEOG 8407. Geocomputation. (3) Cross-listed Course(s): GEOG 6407. Prerequisite(s): GEOG 5120 or permission of instructor. The implementation of computational techniques and resources for the exploration and analysis of (large) spatially referenced databases. Provides an assessment of the place and contribution of computational methods in spatial data handling. Explores "new" computationally intensive approaches to doing geography. Topics include: artificial neural networks, machine learning induction algorithms, genetic and other evolutionary algorithms, and other algorithms for spatial data mining.

GEOG 8408. Spatial Optimization. (3) Cross-listed Course(s): GEOG 6408. Prerequisite(s): GEOG 5120 or permission of instructor. Spatial Optimization is articulated around the explicit use of GIS tools and techniques to solve coverage, distance-decay problems as well as routing problems integrating geographic information. Case studies in various domains such as urban retailing or transportation. Problem formulation and solution techniques to optimally preserve existing natural reserves, such as reservoir resources or locating natural corridors between biologically rich areas to protect diversity.

GEOG 8500. Urban Planning: Theory and Practice. (3) Cross-listed Course(s): GEOG 6500 and PPOL 8616. Critical assessment of alternative planning theories and their application to planning practices. Examination of economic, political, social, cultural and geographical factors affecting the operations of cities and resource distribution.

GEOG 8600. Transportation Policy. (3) Cross-listed Course(s): GEOG 6600 and PPOL 8613. Examination of surface transportation from a public policy perspective. Institutional components and role of government at all levels influencing investment; changes in technology, environment, security, safety, equity, cost-effectiveness, public health and welfare are covered.

GEOG 8612. Advanced Geography of Transportation Systems. (3) Cross-listed Course(s): GEOG 6612. Prerequisite(s): GRAD 6101, GRAD 8101, or permission of instructor. Exploration of transportation systems from a geographic perspective. The course emphasizes the importance of these systems in the past, present and future. The course explores the relationships between the organization of the space economy and transportation, the flow of people, commodity and ideas at different scales of observation from the small picture (urban transportation) to the big, global picture (international transportation), mobility issues in everyday life and in the economy. The social, economic, physical, and political contexts of transportation systems are discussed. The course is also designed to develop analytical capabilities by using a few fundamental techniques of transportation planning and analysis.

GEOG 8632. Ph.D. Professional Development Seminar in Geography. (1) Facilitates professional development and community building among doctoral students enrolled in the Geography program and focuses on skills needed beyond the classroom and lab. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit one time.*

GEOG 8800. Directed Problems in Geography. (1 to 4) Cross-listed Course(s): GEOG 6800. Individual research into geographic topics. *May be repeated once for credit with change of topic.*

GEOG 8901. Dissertation. (1 to 9) Prerequisite(s): Successful completion of qualifying examinations. Under the direction of a dissertation advisor and committee, students design and execute an original research study. This study should address a significant issue or problem related to geography. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit (required minimum total of 18 credit hours).*

Geology (GEOL)

GEOL 5000. Topics in Geology. (1 to 4) Prerequisite(s): ESCI 1101, GEOL 1200, and GEOL 1200L; or permission of instructor. In-depth treatment of specific topics selected from one of the fields of geology. *May be repeated for credit with change of topic.*

GEOL 5100. Igneous and Metamorphic Petrology. (4) Prerequisite(s): GEOL 3115. Classification, mineralogy and chemical properties of igneous and metamorphic rocks including the tectonic processes by which they formed. Lab emphasizes hand specimen and petrographic description and interpretation of rocks in thin sections.

GEOL 5105. Geomorphology. (4) Cross-listed Course(s): GEOL 4105. Prerequisite(s): ESCI 1101, GEOL 1200, and GEOL 1200L. Discusses surficial processes and landform development as controlled by climate, tectonics, rock characteristics and time. An emphasis is placed on field-based analyses of weathering, erosion, mass wasting (landslides and rock falls), and surface water processes (flooding and floodplains), and how climate change and tectonics may affect them in landscape development.

GEOL 5110. Stratigraphy. (4) Prerequisite(s): GEOL 1210 and GEOL 3124. Vertical and horizontal relationships of layered earth materials as a key to understanding basin history, past depositional environments and their transformation through time. Three lecture hours, three lab hours per week.

GEOL 5115. Applied Geophysics. (4) Cross-listed Course(s): GEOL 4115. Prerequisite(s): GEOL 1200 or permission of instructor. Instrumental analysis of Earth's geophysical parameters. Study of human-induced seismic and electrical signals, and natural magnetic and gravitational fields for the purposes of locating faults, ore bodies, ground water, and geotechnical or archaeological targets. Three hours of lecture and one three-hour lab per week.

GEOL 5120. Geologic Mapping and Interpretation. (4) Prerequisite(s): GEOL 3130 and GEOL 5100, or permission of instructor. Field and lab oriented study using principles of mineralogy, petrology and structural geology. Involves collection and resolution of field data, techniques of presenting data, development of geologic maps, and critical reviews of existing literature. Two hours of lecture, four hours of lab/field work per week.

GEOL 5125. Geologic Summer Field Camp. (6) Prerequisite(s): Permission of instructor. Concentrated field investigation of geologic features. Data collection in the field, geologic mapping, report and map preparation and time management. Location of field camp is specified each time course is offered.

GEOL 5130. Optical Mineralogy. (4) Prerequisite(s): GEOL 3115. Light optics theory, the behavior of plane polarized light in a solid medium. The laboratory emphasizes the use of petrographic microscope oil immersion techniques and identification of the common rock forming minerals. Three hours of lecture and one three-hour lab per week.

GEOL 5135. Tectonics. (4) Prerequisite(s): GEOL 3130 or permission of instructor. A systematic examination of the evolution and dynamics of the earth from the perspective of plate tectonics theory. Three lecture hours, one three-hour lab per week.

GEOL 5140. Coastal Geology. (3) Prerequisite(s): GEOL 1200 and GEOL 1210, or permission of instructor. Examination of coastal environments, sediments, and wave-related processes in the present and geologic past. Topics include: barrier-island and salt-marsh development, sea-level fluctuations, and the relationship between human development and natural hazards. Three hours seminar per week and one mandatory two-day field trip.

GEOL 5145. Hydrogeology. (4) Prerequisite(s): GEOL 1200 or ESCI 1101; and CHEM 1251; or permission of instructor. Fundamentals of physical and chemical groundwater hydrology. Principles of flow, transport, and chemical reactions in aquifers and the vadose zone, including groundwater-surface water interactions. Three hours of lecture and three hours of lab per week, with occasional field trips.

GEOL 5165. Aqueous and Environmental Geochemistry. (3) Prerequisite(s): CHEM 1251, CHEM 1252, and GEOL 1200, or equivalent; or permission of instructor. Water-rock interaction and processes controlling the chemical composition of natural waters (streams, lakes, and groundwater). Topics include: the carbonate system, mineral precipitation/dissolution, redox reactions, and metal speciation.

GEOL 5175. Geochemistry. (3) Prerequisite(s): CHEM 1251, GEOL 1200, and GEOL 1200L; or permission of instructor. Geochemical survey of origin, evolution and present composition of the earth.

GEOL 5175L. Geochemistry Laboratory. (1) Pre- or Corequisite(s): GEOL 5175 or permission of instructor. Analytical methods and sample preparation techniques used by geochemists. One three hour meeting per week.

GEOL 5185. Mineralogy, Economics and the Environment. (3) The origin, distribution, and consumption rate of the Earth's mineral resources. This lecture-based course promotes an understanding of not only the geologic, engineering and economic factors that govern mineral

production, but also the resulting environmental pollution problems.

GEOL 5410. Applied Soil Science. (4) Prerequisite(s): ESCI 4210, ESCI 5210, or permission of instructor. Read and discuss current literature pertaining to the application of soils to various fields of research such as surficial processes, active tectonics, ecology, stratigraphy, archaeology, and environmental assessment. Topics covered vary depending on the interests of the students. Students create and execute a semester-long soils-based field or laboratory research project of their choosing. Three hours seminar, three hours field or lab each week.

GEOL 6101. Earth Systems Analysis: Geodynamics. (3) Current working hypotheses and research methods are reviewed for the study of crustal and lithospheric processes on time scales from the seismic cycle to the long-term geologic evolution of basins and mountain belts and on physical scales ranging from the fracture and flow of rock masses to regional deformation and mountain building.

GEOL 6102. Earth Systems Analysis: Paleoenvironments. (3) Current working hypotheses and research methods are reviewed for the study of paleoenvironments. The interrelationships of tectonics, sediment supply and eustacy, and their effects on paleogeography and biogeography are discussed, and compared to studies of analogous modern depositional environments.

GEOL 6103. Earth Systems Analysis: Solid Earth Geochemistry. (3) Current working hypotheses and research methods are reviewed for the study of the geochemical evolution of the Earth's continental and oceanic crust. Hypotheses regarding coupling between solid earth geochemical processes and the evolution of the Earth's atmosphere and oceans are also briefly discussed.

GEOL 6651. Workshops in Geology. (4) A series of lectures on subject matter of the lithosphere and space science with accompanying laboratory sessions.

GEOL 6800. Individual Study in Geology. (1 to 4) Prerequisite(s): Permission of instructor and credit hours established in advance. Tutorial study or special research problems. *May be repeated for credit with change of topic.*

German (GERM)

GERM 5010. Periods in the History of German Literature. (3) (a) Medieval literature, (b) Classicism, (c) Romanticism, (d) Nineteenth Century, (e) Contemporary literature. Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Study of the major writers and works in a given period. Readings, lectures, and reports. *May be repeated for credit with change of topic.*

GERM 5020. The Chief Genres in German Literature. (3) (a) Novel, (b) Theater, (c) Lyric poetry, (d) short prose fiction. Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. An analysis of a major genre and its development within German literary history. Readings, lectures and reports. *May be repeated for credit with change of topic.*

GERM 5050. Special Topics in German. (1 to 3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Treatment of a special group or figure in German literature, specialized topic in German culture or language, or special problems in German conversation. *May be repeated for credit with change of topic.*

GERM 5120. Advanced Business German I. (3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Advanced studies in Business German, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as economics, management, and marketing.

GERM 5121. Advanced Business German II. (3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Advanced studies in Business German, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as marketing, finance, and import-export.

GERM 5203. Survey of German Literature I. (3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. General introduction to German literature from the Middle Ages to the Classical Period. Book reports and class discussion on collateral readings.

GERM 5204. Survey of German Literature II. (3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. German literature since Classicism. Book reports and discussions on collateral readings.

GERM 5410. Professional Internship in German. (1 to 6) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Faculty-supervised field and/or research experience in a cooperating profession (e.g., business) or community organization. Contents of internship based upon a contractual agreement among the student, department, and business or community organization.

GERM 5800. Directed Individual Study. (1 to 3) Prerequisite(s): Post-baccalaureate status, B.A. in German, or permission of department. Individual work on a selected area study. To be arranged with the instructor, generally during the preceding semester, and by special permission only. *May be repeated for credit.*

Graduate Life and Learning (GRAD)

GRAD 6000. Topics in Graduate Professional Development. (1 to 3) Cross-listed as GRAD 8000. Various professional development topics are offered through this course. The topics relate to the professional competencies that guide professional development training for graduate students at UNC Charlotte, such as leadership, communications, teaching, writing, or professional ethics. *May be repeated with change of topic.*

GRAD 6009. Topics in Graduate Studies. (3) Cross-listed as GRAD 8009. Specialized topics in graduate studies. *May be repeated for credit with change in topic.*

GRAD 6100. Basic Statistics and Probability. (3) Basic statistics and probability theory that prepares students for linear regression. Students are expected to learn SAS, STATA, and R during the course of the semester by participating in modules offered by Project Mosaic. By the end of the semester, students should know the steps that need to be taken to clean data prior to analysis, strategies for combining data, basic descriptive statistics. They will also understand sampling theory, inferential statistics, and sampling distributions. *May not be repeated for credit.*

GRAD 6101. Linear Regression. (3) Cross-listed as GRAD 8101. Prerequisite(s): GRAD 6100 or equivalent. Linear regression models, and the ordinary least squares (OLS) estimators that are often used to estimate them, are robust tools employed by social scientists to both explain and predict social phenomena. Moreover, basic linear regression and OLS are part of the foundation one must have to understand more sophisticated variants of the linear model (e.g., time series, structural equations), as well as non-linear models (e.g., logistic regression, multinomial logit, Poisson regression). As such, the class has two primary purposes: 1) conveying a basic understanding of the linear regression model so that students are able to both employ the technique in their own research and comprehend research employing the technique; and 2) provide a strong foundation in the underlying model such that they will have little difficulty in future classes that move beyond the OLS framework. *May not be repeated for credit.*

GRAD 6102. Categorical Outcomes. (3) Cross-listed as GRAD 8102. Prerequisite(s): GRAD 6101 or equivalent. While linear models like ordinary least squares regression are robust and useful, they are only applicable when your dependent variable is continuous and uncensored. Unfortunately, social scientists often want to explain phenomena that are "limited" in that they are not continuous and/or uncensored. Fortunately, there are alternative estimation techniques for analyzing most models with non-continuous (e.g., dichotomous, nominal, ordinal) and/or censored (e.g., event count or event history) dependent variables. A variety of techniques are examined for estimating models with "limited" dependent variables. *May not be repeated for credit.*

GRAD 6103. Classificatory Methods and Time Series. (3) Cross-listed as: GRAD 8103. Prerequisite(s): GRAD 6101 or equivalent. Introduction to three methods for analyzing quantitative data that are used frequently in social science and policy research. These are two classificatory methods, factor analysis and cluster analysis, and an extensive overview of time series analysis. Students are required to be familiar with the principles of statistical analysis and, in particular, with regression analysis to be enrolled in this class. *May not be repeated for credit.*

GRAD 6104. Spatial Statistics. (3) Cross-listed as GRAD 8104, GEOG 6120, GEOG 8120, and INES 8090. Prerequisite(s): GRAD 6101 or equivalent. Introduction to modern spatial statistics methods and their applications for the analysis of spatial data. Fundamental characteristics of spatial data, including spatial dependence, stationarity, and isostropy are covered. Three main categories of spatial statistics are given focus: spatial point pattern analysis, spatial prediction and geostatistics, and spatial regression. Hands-on practices are given to facilitate the understanding of theories and methods of spatial statistics. *May not be repeated for credit.*

GRAD 6151. Professional Communications. (1) Cross-listed as GRAD 8151 and BINF 8151. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references and avoiding plagiarism. Students critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students learn how to properly organize and run a meeting. Students prepare a CV, job application letter, and job talk.

GRAD 6201. Teaching at the University Level. (3) Cross listed as GRAD 8201. Designed for graduate students who teach or intend to teach in the future. Topics include: developing a teaching philosophy, constructing a syllabus, using student demographics and learning styles in course design, managing controversial topics, incorporating active learning and critical thinking, constructing rubrics,

assessment, and applying theories of cognitive development, learning, and motivation to the classroom. Students lecture throughout the semester in order to gain teaching experience and to benefit from peer review.

GRAD 6202. Teaching at American Colleges or Universities: Perspectives for International Students. (3) Cross-listed as GRAD 8202. This course, which offers the same curriculum and pedagogy as GRAD 6201 and GRAD 8201, is designed for and offered to international graduate students who wish to teach at American colleges or universities. The unique perspectives and cultural experiences of international graduate students are sought and utilized in covering such topics as developing a teaching philosophy, constructing a syllabus, understanding American students' demographics and learning styles, incorporating active learning and critical thinking, constructing rubrics for use in testing and grading, and applying theories of learning and motivation to the classroom. From this foundation, students teach during class meetings to gain experience and benefit from peer review. Language support is offered as needed.

GRAD 6210. Graduate-Level Writing for International Students. (3) Cross-listed as GRAD 8210. Designed to benefit English as a Second Language (ESL) graduate students and serves as an introduction to concepts central to graduate-level writing in the United States, such as academic integrity, audience awareness, discipline-specific variation in writing norms and culture, and rhetorical purpose. *Graded on a Pass/Unsatisfactory basis.*

GRAD 6212. Academic Writing. (3) Cross-listed Course(s): GRAD 8212. Prerequisite(s): GRAD 6210 (for non-native English-speaking graduate students). Benefits graduate students who are actively writing empirical journal articles, theses, and dissertations. Attention is given to both producing features of effective research writing and implementing strategies to successfully produce such writing. *Graded on a Pass/Unsatisfactory basis.*

GRAD 6240. Research Ethics in the Biological and Behavioral Sciences. (3) Cross-listed as PHIL 6240. Designed to identify the fundamental elements that characterize not only methodologically grounded but also morally appropriate scientific research. Class discussion and readings focus on key issues in biological and behavioral research including informed consent, privacy and confidentiality, risk-benefit assessments, mechanisms for protecting animal and human research subjects, international research, vulnerable populations, conflicts of interest and data management, publication ethics, intellectual property issues and the politics of research.

GRAD 6302. Responsible Conduct of Research. (2) Cross-listed as GRAD 8302. An introduction to several aspects of a successful professional career emphasizing research. Designed to benefit graduate students across the University. Focuses on practical skills and critical thinking about the responsible conduct of research, highlighting the nine areas of instruction required by the National Institutes of Health (NIH) and National Science Foundation (NSF). Features several different speakers with expertise in various areas of professionalism and research ethics.

GRAD 6304. Intrapreneurship for Non-Business Majors - The Practice of Internal Entrepreneurs. (2) Introduces the concepts and application of intrapreneurship (organizational internal entrepreneurship) in order to utilize the student's disciplinary expertise in an organization. The basics of the practice of entrepreneurship in and by organizations in three ways are covered. First, why internal entrepreneurship? Second, what are the challenges for innovation within an organization? Third, how do you become entrepreneurial?

GRAD 6320. Personal Career Branding: Identity, Management, and Promotion. (2) Cross-listed as GRAD 8320. Students learn how to identify meaningful career paths, manage their preparation towards various careers, and understand how to best promote themselves to future employers. Students also gain practice and knowledge around their strengths, values, personality, effective communication, and organizational evaluation as it relates to their professional career journey. Developing and practicing core career competencies contribute to students' overall career brand, confidence level around their career path, and their connection to targeted industries of choice.

GRAD 6330. Workplace Communications. (2) The principles of good communication in the workplace, focusing on the special needs of writing in technical fields such as health, the sciences, and business. Emphasis is placed on communicating effectively in an increasingly diverse world.

GRAD 6340. Data Analysis and Presentation for Impact. (2) Cross-listed as GRAD 8340. Prerequisite(s): Enrollment in a graduate program at UNC Charlotte, with an undergraduate or graduate degree that includes some math, statistics, finance, or other quantitative coursework. Students learn to gather, organize, and present data for understanding and impact. They then use this data to answer questions and test hypotheses; to make predictions; and for sensitivity analysis and decision-making.

GRAD 6350. Leadership Essentials. (2) Cross-listed Course(s): GRAD 8350. Provides students clarity as to who they are as leaders. They have the opportunity to get in touch with their strengths and identify where there are opportunities for growth, while understanding various leadership styles. Students are better equipped to

effectively manage their work and relationships and to be more productive in their organizations. They understand how to apply different leadership practices in different settings.

GRAD 7800. Master's Thesis - Graduate Full-Time Enrollment. (3) Master's students pursuing the thesis option only may enroll in this course if they have: (1) completed all required coursework, and (2) submitted required milestone forms to the Graduate School (Comprehensive Exam Report or Portfolio or Study Report, Thesis Committee form, and Proposal Defense form). Students registered for this non-graded course are considered "full-time enrolled." *May be repeated with permission of Graduate School.*

GRAD 7999. Master's Graduate Residency Credit. (1) Prerequisite(s): Permission of the Graduate School. Meets Graduate School requirement for continuous enrollment during final term prior to graduation when all degree requirements (including thesis and/or project) have been completed or will be completed in the first four weeks of the semester. This course is non-graded, and credit for this course does not count toward the degree. *May be repeated with permission.*

GRAD 8000. Topics in Graduate Professional Development. (1 to 3) Cross-listed as GRAD 6000. Various professional development topics are offered through this course. The topics relate to the professional competencies that guide professional development training for graduate students at UNC Charlotte, such as leadership, communications, teaching, writing, or professional ethics. *May be repeated with change of topic.*

GRAD 8009. Topics in Graduate Studies. (3) Cross-listed as GRAD 6009. Specialized topics in graduate studies. *May be repeated for credit with change in topic.*

GRAD 8100. Accelerated Introduction to Quantitative Techniques. (2) Prerequisite(s): Enrollment in doctoral program at UNC Charlotte. A two week course intended to prepare students for required core economics and statistics courses. Covers math basics, a brief introduction to calculus (single variable derivatives and integrals), fundamentals of probability and an introduction to statistical software. *May not be repeated for credit.*

GRAD 8101. Linear Regression. (3) Cross-listed as GRAD 6101. Prerequisite(s): GRAD 6100 or equivalent. Linear regression models, and the ordinary least squares (OLS) estimators that are often used to estimate them, are robust tools employed by social scientists to both explain and predict social phenomena. Moreover, basic linear regression and OLS are part of the foundation one must have to understand more sophisticated variants of the linear model (e.g., time series, structural equations), as well as non-linear models (e.g., logistic regression, multinomial logit, Poisson regression). As such, the class has two primary purposes: 1) conveying a basic understanding of the linear regression model so that students are able to both employ the technique in their own research and comprehend research employing the technique; and 2) provide a strong foundation in the underlying model such that they will have little difficulty in future classes that move beyond the OLS framework. *May not be repeated for credit.*

GRAD 8102. Categorical Outcomes. (3) Cross-listed as GRAD 6102. Prerequisite(s): GRAD 8101 or equivalent. While linear models like ordinary least squares regression are robust and useful, they are only applicable when your dependent variable is continuous and uncensored. Unfortunately, social scientists often want to explain phenomena that are "limited" in that they are not continuous and/or uncensored. Fortunately, there are alternative estimation techniques for analyzing most models with non-continuous (e.g., dichotomous, nominal, ordinal) and/or censored (e.g., event count or event history) dependent variables. A variety of techniques are examined for estimating models with "limited" dependent variables. *May not be repeated for credit.*

GRAD 8103. Classificatory Methods and Time Series. (3) Cross-listed as: GRAD 6103. Prerequisite(s): GRAD 8101 or equivalent. Introduction to three methods for analyzing quantitative data that are used frequently in social science and policy research. These are two classificatory methods, factor analysis and cluster analysis, and an extensive overview of time series analysis. Students are required to be familiar with the principles of statistical analysis and, in particular, with regression analysis to be enrolled in this class. *May not be repeated for credit.*

GRAD 8104. Spatial Statistics. (3) Cross-listed as GRAD 6104, GEOG 6120, GEOG 8120, and INES 8090. Prerequisite(s): GRAD 8101 or equivalent. Introduction to modern spatial statistics methods and their applications for the analysis of spatial data. Fundamental characteristics of spatial data, including spatial dependence, stationarity, and isostropy are covered. Three main categories of spatial statistics are given focus: spatial point pattern analysis, spatial prediction and geostatistics, and spatial regression. Hands-on practices are given to facilitate the understanding of theories and methods of spatial statistics. *May not be repeated for credit.*

GRAD 8151. Professional Communications. (1) Cross-listed as GRAD 6151 and BINF 8151. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references and avoiding plagiarism. Students critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students learn how to properly

organize and run a meeting. Students prepare a CV, job application letter, and job talk.

GRAD 8201. Teaching at the University Level. (2 to 3) Cross listed as GRAD 6201. Designed for graduate students who teach or intend to teach in the future. Topics include: developing a teaching philosophy, constructing a syllabus, using student demographics and learning styles in course design, managing controversial topics, incorporating active learning and critical thinking, constructing rubrics, assessment, and applying theories of cognitive development, learning, and motivation to the classroom. Students lecture throughout the semester in order to gain teaching experience and to benefit from peer review. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8202. Teaching at American Colleges or Universities: Perspectives for International Students. (3) Cross-listed as GRAD 6202. This course, which offers the same curriculum and pedagogy as GRAD 6201 and GRAD 8201, is designed for and offered to international graduate students who wish to teach at American colleges or universities. The unique perspectives and cultural experiences of international graduate students are sought and utilized in covering such topics as developing a teaching philosophy, constructing a syllabus, understanding American students' demographics and learning styles, incorporating active learning and critical thinking, constructing rubrics for use in testing and grading, and applying theories of learning and motivation to the classroom. From this foundation, students teach during class meetings to gain experience and benefit from peer review. Language support is offered as needed. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8210. Graduate-Level Writing for International Students. (3) Cross-listed as GRAD 6210. Designed to benefit English as a Second Language (ESL) graduate students and serves as an introduction to concepts central to graduate-level writing in the United States, such as academic integrity, audience awareness, discipline-specific variation in writing norms and culture, and rhetorical purpose. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8212. Academic Writing. (3) Cross-listed Course(s): GRAD 6212. Prerequisite(s): GRAD 6210 or GRAD 8210 (for non-native English-speaking graduate students). Benefits graduate students who are actively writing empirical journal articles, theses, and dissertations. Attention is given to both producing features of effective research writing and implementing strategies to successfully produce such writing. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8240. Research Ethics in the Biological and Behavioral Sciences. (3) Cross-listed as PHIL 8240. Designed to identify the fundamental elements that characterize not only methodologically grounded but also morally appropriate scientific research. Class discussion and readings focus on key issues in biological and behavioral research including informed consent, privacy and confidentiality, risk-benefit assessments, mechanisms for protecting animal and human research subjects, international research, vulnerable populations, conflicts of interest and data management, publication ethics, intellectual property issues and the politics of research. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8302. Responsible Conduct of Research. (2) Cross-listed as GRAD 6302. An introduction to several aspects of a successful professional career emphasizing research. Designed to benefit graduate students across the University. Focuses on practical skills and critical thinking about the responsible conduct of research, highlighting the nine areas of instruction required by the National Institutes of Health (NIH) and National Science Foundation (NSF). Features several different speakers with expertise in various areas of professionalism and research ethics. *Required course for all doctoral students. Graded on a Pass/Unsatisfactory basis.*

GRAD 8320. Personal Career Branding: Identity, Management, and Promotion. (2) Cross-listed as GRAD 6320. Students learn how to identify meaningful career paths, manage their preparation towards various careers, and understand how to best promote themselves to future employers. Students also gain practice and knowledge around their strengths, values, personality, effective communication, and organizational evaluation as it relates to their professional career journey. Developing and practicing core career competencies contribute to students' overall career brand, confidence level around their career path, and their connection to targeted industries of choice. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8340. Data Analysis and Presentation for Impact. (2) Cross-listed as GRAD 6340. Prerequisite(s): Enrollment in a graduate program at UNC Charlotte, with an undergraduate or graduate degree that includes some math, statistics, finance, or other quantitative coursework. Students learn to gather, organize, and present data for understanding and impact. They then use this data to answer questions and test hypotheses; to make predictions; and for sensitivity analysis and decision-making.

GRAD 8350. Leadership Essentials. (2) Cross-listed Course(s): GRAD 6350. Provides students clarity as to who they are as leaders. They have the opportunity to get in touch with their strengths and identify where there are opportunities for growth, while understanding various leadership styles. Students are better equipped to effectively manage their work and relationships and to be

more productive in their organizations. They understand how to apply different leadership practices in different settings. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8610. Making Dissertations Happen: Managing Writing and Life. (2) Prerequisite(s): Enrollment in doctoral program and actively writing dissertation. Designed to help doctoral-level writers be more resilient in the face of numerous potential challenges by providing support in the dissertation process. Focuses on best practices for improving writing productivity, managing stress and procrastination, dealing with adversity during the dissertation process, and strengthening and maintaining key relationships. Structured to cultivate community among dissertation writers, because writers can benefit from peer support during the dissertation process. *Graded on a Pass/Unsatisfactory basis.*

GRAD 8990. Academic Integrity. (0) Online training addressing issues of academic integrity and the University's policy and procedures related to violations. Required of all new doctoral students. *No credit, non-graded.*

GRAD 9800. Doctoral - Graduate Full-Time Enrollment Credit. (3) Prerequisite(s): Permission of the Graduate School. Doctoral students who have: (1) completed all required coursework and (2) submitted required milestone paperwork to the Graduate School (Exam Report of Comprehensive Examination, Appointment of Doctoral Dissertation Committee or DNP Scholarly Project form, and the Proposal Defense form) may register for this non-graded course and be considered "full-time enrolled" students. *May be repeated with permission of Graduate School.*

GRAD 9999. Doctoral Graduate Residency Credit. (1) Prerequisite(s): Permission of the Graduate School. Meets Graduate School requirement for continuous enrollment during final term prior to graduation when all degree requirements (including dissertation) have been completed or will be completed in the first four weeks of the semester. This course is non-graded, and credit for this course does not count toward the degree. *May be repeated with permission.*

Gerontology (GRNT)

GRNT 5050. Topics in Gerontology. (1 to 4) Investigation of specific issues in Gerontology, either from the perspective of a single discipline or from a multidisciplinary perspective. *May be repeated for credit with change of topic.*

GRNT 5150. Older Individual and Society. (3) Cross-listed Course(s): GRNT 4150, SOCY 4150, and SOCY 5150. Study of the social and cultural context on the lives of aging individuals in American society. Includes a focus on expectations, social interactions, and psychological well-being in the context of retirement, caregiving, and health.

GRNT 5250. Aging Programs and Services. (3) Examination of federal, state and local framework of services and programs for the aging. Graduate students required to complete a more extensive final paper.

GRNT 5260. Women: Middle Age and Beyond. (3) Position of older women in society and the particular problems and issues for women as they age.

GRNT 5270. Intergenerational Relationships and Programs. (3) Exploration of the importance of and consequences of intergenerational relationships and the range of programming currently available to encourage interaction between people of different ages.

GRNT 5280. The Experience of Dementia. (3) Provides an overview of Alzheimer's disease and related disorders using a person-centered perspective. This topic is explored from the perspectives of the person diagnosed, family members and concerned friends, and both informal and formal caregivers. Students who successfully complete this course will gain a holistic insight into these disorders and their implications for both individuals and society.

GRNT 5290. The Experience of Loneliness. (3) Cross-listed Course(s): GRNT 4290, SOCY 4290, and SOCY 5290. Explores the experience of loneliness among older adults in society. Drawing on academic texts, empirical research and personal accounts of loneliness, the aim is to identify the extent of loneliness experienced by older adults in various contexts. In particular, the readings consider the consequences of loneliness on the physical, mental, and social well-being of older adults.

GRNT 5353. Environments for Aging. (3) With roots in environmental psychology, this course explores the ways in which older adults experience and interact with their physical environment at both the macro and micro levels. Students are introduced to the values and practices of a broad spectrum of housing alternatives for an aging population, which include traditional and household models of long term care, therapeutic environments for individuals with dementia, Naturally Occurring Retirement Communities (NORCS), as well as co-housing and intentional community options.

GRNT 5365. Grief and Loss Across the Lifespan. (3) Cross-listed Course(s): GRNT 4365, SOWK 4365, and SOWK 5365. Equips the professional practitioner to understand and respond effectively to individuals, families, groups, organizations, and communities experiencing both symbolic and tangible losses and accompanying grief

reactions. Topics include: theories of normal and complicated grief, factors that influence grief at different stages of the lifespan, cultural and spiritual influences, traumatic loss, anticipatory grief and end of life care, the impact of loss and working in close contact with grief on professionals, and skills and strategies that address therapeutic needs of vulnerable and resilient populations experiencing grief.

GRNT 6050. Topics in Gerontology. (3) Prerequisite(s): Permission from graduate program director. Investigation of specific issues in Gerontology, either from the perspective of a single discipline or from a multidisciplinary perspective.

GRNT 6124. Psychology of Aging. (3) Cross-listed Course(s): PSYC 6124. Psychology of aging with particular emphasis on issues related to community / clinical psychology and industrial / organizational psychology. Topics include: myths and stereotypes about aging, problems faced by older workers, retirement, mental health and normal aging, counseling the older adult, and psychological disorders in later life.

GRNT 6130. Sociology of Aging: Theories and Research. (3) Cross-listed Course(s): SOCY 6130. Application of stratification theories and demography are applied to the older population. Issues of race, gender, socio-economic status, age, and geographic distribution are examined to investigate the diversity of the older age group and their access to resources.

GRNT 6134. Family Caregiving Across the Lifespan: Theory, Practice, and Policy. (3) Cross-listed Course(s): SOCY 6134 and SOCY 6134. Theories explaining the formation and functioning of American families with an emphasis on the impact of the aging of society. Examines the current demographic trends and expectations of multigenerational families, with a focus on family caregiving. Addresses family care across the lifespan as a lifelong developmental construct, and examines evidence-based approaches to practice, education, research, and policy. Students examine a broad spectrum of care situations (from developmental disability to chronic illness, dementia care, and end of life) that necessitate family caregiving throughout the lifespan and discuss responses to these challenges by both caregiving families and caregiving systems.

GRNT 6201. Research and Methods in Aging I. (3) Prerequisite(s): Statistics. Examination of variety of qualitative and quantitative methods used in research on aging and analysis of Gerontology research from a range of disciplines. Students will develop a working draft of their thesis-applied project proposal.

GRNT 6202. Research and Methods in Aging II. (3) Prerequisite(s): GRNT 6201. Examination of the variety of qualitative and quantitative methods used in evaluation research in applied settings. Students will develop an evaluation project plan.

GRNT 6210. Aging and Public Policy. (3) Cross-listed Course(s): MPAD 6210. Examination of the public policy making process with attention to aging policy. Consideration of determinants of aging policy and institution and actors in the policy making process and piecemeal development of legislation will be analyzed as factors related to the making of policy for the aged.

GRNT 6211. Administration of Aging Programs. (3) Cross-listed Course(s): MPAD 6211. Focus will be implementation of public policies and programs for the aged and the development and administration of these programs. Students will become familiar with the process through which policies are transformed into aging programs and the budgetary, management and evaluative considerations that must be taken into consideration.

GRNT 6238 Intergenerational Issues of Justice. (3) Cross-listed Course(s): PHIL 6238. Examination of intergenerational issues of justice in public policy toward the elderly and their healthcare needs. Issues of justice and morality will be explored in terms of the distribution of limited healthcare resources among competing age groups.

GRNT 6275. Health Promotion, Nutrition, and Wellness for Older Adults. (3) Cross-listed Course(s): NURS 6275. Explores self-care measures and health promotion practices with an emphasis on nutrition, that promote a healthy lifestyle in later life. Topics include: principles of teaching and learning adapted to diverse older adults' needs and learning styles. Common barriers to healthcare and appropriate nutrition in older adults are also examined. Current findings from research will be integrated throughout the course. A foundational knowledge of human development is expected.

GRNT 6400. Practicum. (3) Completion of a field-based educational experience which relates to the student's career goals and objectives. *Graded on a Pass/Unsatisfactory basis.*

GRNT 6600. Current Issues in the Diverse Experiences of Aging. (3) Educates students about issues of aging and social justice by presenting current perspectives that shape culturally-diverse aging experiences in the United States. Using an intersectionality (e.g., race, gender, age, class, sexual orientation, health status, ability, etc.) approach, students explore relevant and challenging issues older adults face, discuss potential solutions, and formulate policy proposals and recommendations to enhance the

quality of life of older adults and their families. Introduces core concepts and ideologies that shape the economics, politics, and cultures of older American minority adults. An interdisciplinary approach is used to understand the diverse experiences of aging and highlights the contributions of researchers, practitioners, and policy makers from multiple disciplines.

GRNT 6800. Independent Research in Gerontology. (3) Graduate students meet individually or in small groups with the instructor and will complete readings and/or research on a topic in gerontology according to a contract. Attendance at lectures of an undergraduate course in Gerontology may be included among course requirements. *May be repeated for credit up to 6 credits.*

GRNT 6990. Applied Project. (3) Prerequisite(s): Permission of graduate program director. Individual project based on directed study of a topic in gerontology. *Graded on a Pass/Unsatisfactory basis.*

GRNT 6999. Master of Arts Thesis. (6) Prerequisite(s): Admission to the M.A. in Gerontology thesis option. The thesis is coordinated with the student's interests and practical experience to allow the development of an area of specialization. A completed paper and oral presentation are required. *Graded on a Pass/Unsatisfactory basis.*

Health Administration (HADM)

HADM 6000. Topics in Health Administration. (3) Intensive study of a topic in health administration. The topic of investigation may vary from semester to semester. *May be repeated for credit.*

HADM 6100. Introduction to the U.S. Healthcare System. (3) Prerequisite(s): Enrollment in MHA, MPH, or M.S. or Graduate Certificate in Health Informatics and Analytics. Overview of healthcare delivery in the United States including organizational structures, financing mechanisms and delivery systems, with particular attention to program formation.

HADM 6104. Population Health and Disease. (3) Cross-listed Course(s): HCIP 6104. Principles and methods of managerial epidemiology grounded in foundational public health knowledge, spanning the social ecological model; essential services, models of health, illness, and disease, including modes of disease transmission and characterization of risk; and paradigms of health promotion and disease prevention within a global, systemic view of health (e.g., One Health).

HADM 6108. Decision Analysis in Healthcare. (3) The study of selected quantitative management tools useful in the analysis of managerial decisions. Includes a review of basic descriptive and inferential statistics, applied probability distributions, forecasting methods, statistical process control, queuing, transportation and assignment modeling, and linear programming. The emphasis is on applying quantitative decision making methods to the operational problems facing healthcare organizations. Familiarity with computers and computer software will be important for success in this course.

HADM 6116. Accounting for Healthcare Management. (3) Basic concepts and techniques of collecting, processing and reporting financial information relevant to healthcare institutions. Emphasizes a conceptual understanding of financial accounting, technical tools of cost accounting, including budget preparation and analysis, and interpretation of financial statements.

HADM 6120. Health Economics. (3) Examination of the economic context of health services delivery and policies, and application of economic concepts to the healthcare sector including supply and demand, elasticity, regulation, competition, and cost effectiveness analysis.

HADM 6124. Marketing in Healthcare. (3) Provides an in-depth understanding of the essential concepts of marketing and their application to healthcare. Students gain a working knowledge of marketing tools and how to use them in the context of healthcare. Students build practical applied skills in analyzing healthcare marketing problems and developing healthcare marketing programs and strategies. Students also expand their understanding of the differences and similarities between health services and social marketing.

HADM 6128. Human Resources Management. (3) Examines human resources management as it applies to health services institutions, including compensation benefits, personnel planning, recruitment, selection, training and development, employee appraisal and discipline, union-management relations, and quality management.

HADM 6134. Quality and Outcomes Management in Healthcare. (3) Cross-listed Course(s): HCIP 6134. Examination of the concepts and practices of quality management, performance improvement, and assessment of outcomes in healthcare delivery settings. Designed to provide an in-depth understanding of basic concepts and frameworks and of their applicability and relevance in specific situations. Examples of topics to be covered include: process reengineering, service improvement, continuous quality improvement, accreditation standards, patient satisfaction, outcome measurement, teamwork, and case management.

HADM 6138. Healthcare Finance. (3) Prerequisite(s): HADM 6116. Fundamental financial management

concepts and tools for healthcare institutions, including financial statements and attributes, capital acquisition and allocation, investment analysis, capital and cash flow management, and contractual relationships.

HADM 6142. Health Policy Development. (3) Cross-listed Course(s): MPAD 6174. Prerequisite(s): HADM 6100/MPAD 6172. Examination of the formulation, adoption and implementation of public policy for health services delivery and healthcare through federal, state, and local political processes.

HADM 6145. Organization Behavior in Healthcare. (3) Introduction to organizational theory with applications to healthcare systems, including organizational design and inter-organizational networks/alliances. Examination of communication and leadership skills development, including conflict, labor, and dispute management.

HADM 6146. Information Resources Management. (3) Cross-listed Course(s): HCIP 6146 and NURS 6162. A study of the use of information management to improve the delivery of healthcare. Information resource management includes methods and practices to acquire, disseminate, store, interpret, and use information to provide healthcare in a more efficient, effective and economical manner. Emphasis is placed upon information as central to the ongoing operations and strategic decisions of healthcare organizations.

HADM 6150. Health Law and Ethics. (3) Cross-listed Course(s): HCIP 6150. Analysis of ethical and bioethical problems confronting healthcare delivery systems. Selected legal principles and their application to the healthcare field, including corporate liability, malpractice, informed consent, and governmental regulation of health personnel and health facilities.

HADM 6154. Strategic Management of Health Services Organizations. (3) Prerequisite(s): Permission of department. Analysis of strategic planning, managing and marketing concepts, techniques and tools within the healthcare industry, including organizational capability analysis and business plan development. This is the Master of Health Administration (MHA) Capstone Course that should be taken during the MHA student's final semester.

HADM 6200. Health Insurance and Managed Care. (3) Fundamentals of managed healthcare systems, including risk arrangements, compensation, incentives, quality assurance, financing, and public programs.

HADM 6204. Trends and Issues in Health Administration. (3) Cross-listed Course(s): MPAD 6176. Examination of current issues confronting healthcare managers and an assessment of programs and management responses to emerging trends in the healthcare filed, including delivery systems, marketing/competition, financing, and/or epidemiological changes.

HADM 6208. Research Methods for Healthcare Administration. (3) Prerequisite(s): undergraduate statistics course. Study of selected statistical techniques useful in the analysis of managerial decisions and interpretation and evaluation of research. Introduction to systems analysis and selected operations research techniques as applied to problem solving and decision making in healthcare institutions.

HADM 6210. Medical Practice Management. (3) Cross-listed Course(s): HCIP 6330. A comprehensive study of medical practice management and the issues, tools, and techniques to resolve those issues. Provides the student with an understanding of the financial and regulatory issues that influence today's medical practice with an insight into the cultural, human resource, and governance issues that make physician practices unique among healthcare organizations.

HADM 6212. Health, Aging, and Long Term Care. (3) Overview of the health status of an aging U.S. population, with a focus on long-term care. Topics include: demographics of an aging society, health status of older people, societal values related to aging and long-term care, informal care giving, the formal service provision system, relevant public policies, and challenges for the future.

HADM 6216. Long Term Care Administration. (3) Overview of the long-term care system, with an emphasis on older persons. Class content includes the exploration of issues surrounding the provision of long-term care, identification of the various components of the long-term care system, and discussion of the role of health administration within the long-term care system.

HADM 6234. Performance Improvement Project Management in Healthcare: An Introduction to Lean Six Sigma. (3) Introduction to the Lean Six Sigma performance improvement methodology, with a focus on application within the healthcare domain. Students learn the tools and methods that are used to improve existing processes and design new, efficient processes by eliminating process waste. Also explored are analytical techniques that allow students to measure and monitor process performance.

HADM 6400. Health Administration Internship. (3) Prerequisite(s): HADM 6100 and 15 additional credit hours of core course requirements. Provides students at the midpoint of their MHA Program supervised, hands-on, administrative experience in a healthcare setting in which to apply foundational knowledge and self-assess competence, career goals, and educational needs.

HADM 6800. Health Administration Independent Study. (1 to 3) Guided individual study in an issue related to health administration arranged with a faculty member or supervised experience in an administrative setting in a program or entity within the healthcare delivery system. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

Health Informatics and Analytics (HCIP)

HCIP 5121. Information Visualization. (3) Cross-listed Course(s): DSBA 5121 and ITCS 5121. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program; and full graduate standing. Information visualization concepts, theories, design principles, popular techniques, evaluation methods, and information visualization applications.

HCIP 5122. Visual Analytics. (3) Cross-listed Course(s): DSBA 5122. Prerequisite(s): HCIP 6380 or permission of instructor; and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program, or the MPH program. Introduces the new field of visual analytics, which integrates interactive analytical methods and visualization. Topics include: critical thinking, visual reasoning, perception/cognition, statistical and other analysis techniques, principles of interaction, and applications.

HCIP 5123. Applied Statistics I. (3) Cross-listed Course(s): STAT 5123. Prerequisite(s): MATH 2164 with a grade of C or above and Junior standing, or permission of department; and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Review of stochastic variables and probability distributions, methods of estimating a parameter, hypothesis testing, confidence intervals, contingency tables. Linear and multiple regression, time series analysis.

HCIP 5160. Applied Databases. (3) Cross-listed Course(s): ITIS 6120 and ITIS 8120. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and Analytics and full graduate standing required. Identification of business database needs; requirements specification; relational database model; SQL; E-R modeling; database design, implementation, and verification; distributed databases; databases replication; object-oriented databases; data warehouses; OLAP; data mining; security of databases; vendor selection; DBMS product comparison; database project management; tools for database development, integration, and transaction control.

HCIP 5166. Network-Based Application Development. (3) Cross-listed Course(s): ITIS 5166. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and Analytics and full graduate standing. Examines the issues related to network based application development. Topics include: introduction to computer networks, web technologies and standards, network based programming methodologies, languages, tools, and standards.

HCIP 5250. Computer Forensics. (3) Cross-listed Course(s): ITIS 5250. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. The identification, extraction, documentation, interpretation, and preservation of computer media for evidentiary purposes and/or root cause analysis. Topics include: techniques for discovering digital evidence; responding to electronic incidents; tracking communications through networks; understanding electronic media, crypto-literacy, data hiding, hostile code, and Windows™ and UNIX™ system forensics; and the role of forensics in the digital environment.

HCIP 5376. Introduction to Programming for Health Informatics. (3) Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and Analytics program, or the MPH program. An introduction to the fundamentals of computer programming, the course provides students essential programming knowledge and skills to perform commonly encountered computational tasks in the field of health informatics. Prepares students for advanced programming and data science courses.

HCIP 6070. Current Issues in Health Informatics. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Current topics and issues related to Health Informatics and Analytics, including health policy analysis and development, ethical issues, structure of health administrative and delivery systems, assessment of population health, models of healthcare delivery, access and quality of care issues.

HCIP 6102. Healthcare Data Analysis. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program, MPH program, or Graduate Certificate in Applied Nursing Informatics program. Develops skills in the management, analysis, and reporting of health data, including introductory applied statistical analysis. Students use statistical software (such as SAS, R, or Python) to run analyses and generate quantitative evidence to inform public health, health policy, healthcare operational, and clinical decision-making that improves quality, reduces health disparities, adjusts for risk, quantifies access, measures population health, and evaluates policies and programs. Focuses on interpreting and visualizing statistical output to generate reports and develop clinical, financial, and operational

recommendations for communication to stakeholders. Touches upon SQL, qualitative methods, and application of legal and ethical precepts to healthcare data analysis.

HCIP 6103. Big Data Analytics for Competitive Advantage. (3) Cross-listed Course(s): DSBA 6100 and ITCS 6100. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. An introduction to the use of big data as a strategic resource. A focus is placed on integrating the knowledge of analytics tools with an understanding of how companies leverage data analytics to gain strategic advantage. A case approach is used to emphasize hands-on learning and a real-world view of big data analytics.

HCIP 6104. Health and Disease. (3) Cross-listed Course(s): HADM 6104. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Principles and methods of epidemiology, including definitions and models of health, illness, and disease; modes of transmission of clinically important infectious agents; risk factors and chronic diseases; and insights into existing studies and paradigms of health promotion and disease prevention.

HCIP 6108. Intermediate Decision Analysis in Healthcare. (3) Prerequisite(s): HCIP 5376; and enrollment in the PSM or Graduate Certificate in Health Informatics and Analytics program, or the MPH program. Addresses the use of quantitative management tools for medical decision-making in populations. Topics include: the use of decision trees, Markov models, Monte Carlo simulation, and forecasting methods to address uncertainty in decision-making. Students work in cluster teams to complete assignments, culminating in a real-world decision model addressing a current medical decision.

HCIP 6112. Software System Design and Implementation. (3) Cross-listed Course(s): ITCS 6112 and ITIS 6112. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Introduction to the techniques involved in the planning and implementation of large software systems. Emphasis on applying quantitative decision making methods to the operational problems facing healthcare organizations. Familiarity with computers and computer software will be important for success in this course.

HCIP 6134. Quality and Outcomes Management in Healthcare. (3) Cross-listed Course(s): HADM 6134. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Examination of the concepts and practices of quality management, performance improvement, and assessment of outcomes in healthcare delivery settings. Designed to provide an in-depth understanding of basic concepts and frameworks and of their applicability and relevance in specific situations. Topics include: process reengineering, service improvement, continuous quality improvement, accreditation standards, patient satisfaction, outcome measurement, teamwork, and case management.

HCIP 6146. Information Resources Management. (3) Cross-listed Course(s): HADM 6146. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. A study of the use of information management to improve the delivery of healthcare. Information resource management includes methods and practices to acquire, disseminate, store, interpret and use information to provide healthcare in a more efficient, effective and economical manner. Emphasis is placed upon information as central to the ongoing operations and strategic decisions of healthcare organizations.

HCIP 6150. Health Law and Ethics. (3) Cross-listed Course(s): HADM 6150. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Analysis of ethical and bioethical problems confronting healthcare delivery systems. Selected legal principles and their application to the healthcare field, including corporate liability, malpractice, informed consent and governmental regulation of health personnel and health facilities.

HCIP 6156. Applied Machine Learning. (3) Cross-listed Course(s): DSBA 6156. Prerequisite(s): Full graduate standing and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Practical perspectives and applications of machine learning methods and techniques including: acquisition of declarative knowledge; organization of knowledge into new, more effective representations; development of new skills through instruction and practice; and discovery of new facts and theories through observation and experimentation.

HCIP 6160. Database Systems for Data Scientists. (3) Cross-listed Course(s): DSBA 6160. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and Analytics or MPH programs. The modeling, programming, integration, and provenance of big data. Focuses on SQL and NoSQL, but may also address other advanced topics. Topics include: (1) modeling/theory: basics of RDBMS and NoSQL, database design; (2) programming: SQL and NoSQL query languages; (3) integration: data warehousing, preprocessing; (4) databases in the Cloud; and (5) provenance: data version control, data lifecycle management.

HCIP 6162. Knowledge Discovery in Databases. (3) Cross-listed Course(s): DSBA 6162, ITCS 6162, and ITIS 6162. Prerequisite(s): ITCS 6160 or ITIS 6120; and Enrollment in

PSM or Graduate Certificate in Health Informatics and Analytics program. Exploration of the entire knowledge discovery process. Topics include: setting up a problem, data preprocessing and warehousing, data mining in search for knowledge, knowledge evaluation, visualization and application in decision making. A broad range of systems, such as OLAP, LERS, DatalogicR+, C4.5, AQ15, Forty-Niner, CN2, QRAS, and discretization algorithms are also covered.

HCIP 6163. Data Warehousing. (3) Cross-listed Course(s): ITCS 6163 and ITIS 6163. Prerequisite(s): ITCS 6160 or ITIS 6120; and Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Topics include: use of data in discovery of knowledge and decision making; the limitations of relational databases and SQL queries; the warehouse data models: multidimensional, star, snowflake; architecture of a data warehouse and the process of warehouse construction; data consolidation from various sources; optimization; techniques for data transformation and knowledge extraction; relations with enterprise modeling.

HCIP 6167. Network Security. (3) Cross-listed Course(s): ITIS 6167. Prerequisite(s): ITIS 6200 or equivalent and Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Examines the issues related to network security. Topics include: network security background and motivation, network centric threats, network authentication and identification, network security protocols, firewall, IDS, security in wireless environments, email security, instant message security, network application security, and network based storage security. There are heavy lab based components in this course.

HCIP 6199. Principles of Computer Networks and Databases. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Computer concepts (hardware components, systems architectures, operating systems and languages, and software packages and tools); Communications technologies (networks—LANS, WANS, VPNs; data interchange standards— NIST, HL-7); Internet technologies (Intranet, web-based systems, standards – SGML, XML); Data, information and file structures (data administration, data definitions, data dictionary, data modeling, data structures, data warehousing, database management systems); Data storage and retrieval (storage media, query tools/applications, data mining, report design, search engines); Data security (protection methods—physical, technical, managerial, risk assessment, audit and control program, contingency planning, data recovery, Internet, web-based, and eHealth security).

HCIP 6200. Principles of Information Security and Privacy. (3) Cross-listed Course(s): ITIS 6200 and ITIS 8200. Prerequisite(s): Permission of department. Topics include: security concepts and mechanisms; security technologies; authentication mechanisms; mandatory and discretionary controls; basic cryptography and its applications; database security, intrusion detection and prevention; assurance requirement, assurance class, evaluation methods and assurance maintenance; anonymity and privacy issues for information systems.

HCIP 6201. Health Information Privacy and Security: Law, Ethics, and Technology. (3) Prerequisite(s): Enrollment in PSM in Health Informatics and Analytics program. A foundational exposure to legal and ethical issue related to health information privacy and security and the basic technological considerations to meet those professional obligations in health informatics practice.

HCIP 6210. Access Control and Security Architecture. (3) Cross-listed Course(s): ITIS 6210. Prerequisite(s): ITIS 6200 and Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Discusses objectives, formal models, and mechanisms for access control; and access control on commercial off-the-shelf (COTS) systems. Examines the issues related to security architectures and technologies for authorization. Topics include: cryptographic infrastructure, distributed systems security architectures, database systems security architectures, Internet security architectures, network security architectures, and e-commerce security architectures.

HCIP 6213. Applied Healthcare Business Analytics. (3) Cross-listed Course(s): DSBA 6213 and MBAD 6213. Pre-requisites: Demonstrated proficiency with Microsoft Excel; and either HCIP 5123, STAT 5123, HADM 6108 (for students with background in healthcare administration), HCIP 6108 (for students with background in healthcare informatics), or equivalent. Focuses on applying business analytics within the healthcare setting. Students learn analytical tools used to synthesize big data into meaningful management information that is used in making key business decisions that impact the delivery of healthcare services. Case studies are utilized to prepare students for delivering boardroom level presentations of their findings.

HCIP 6228. Medical Informatics. (3) Cross-listed Course(s): ITCS 6228. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and graduate standing. Focuses on methods and techniques used in storage, communication, processing, analysis, integration, management, and distribution of medical information. Emphasizes the applications of telemedicine and intelligent computer-aided decision making systems in different medical and surgical systems. Discusses the computational methods to accept or reject a new drug or a new treatment for a given disease.

HCIP 6230. Enterprise and Infrastructure Protection. (3) Cross-listed Course(s): ITIS 6230 and ITIS 8230. Prerequisite(s): ITIS 6200; and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Methodologies, tools, and technologies that are important for protecting data and network security in both enterprises and critical infrastructures. Topics include: the prevent-detect-response strategy for enterprise security, policies, techniques, processes and methodologies for risk assessment and management, infrastructure reconnaissance and vulnerability analysis, basics of forensics, methodologies for continuous operation and recovery from disasters.

HCIP 6240. Applied Cryptography. (3) Cross-listed Course(s): ITIS 6240. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and full graduate standing. Provides students with an understanding of modern cryptographic techniques, algorithms and protocols that are of fundamental importance to the design and implementation of security critical applications. Covers not only standard cryptographic techniques, but also exposes students to the latest advances in applied cryptography. Topics include: secret and public key ciphers, stream ciphers, one-way hashing algorithms, authentication and identification, digital signatures, key establishment and management, secret sharing and data recovery, public key infrastructures, and efficient implementation.

HCIP 6250. Capstone: Problem-Solving in Healthcare Analytics. (3) Prerequisite(s): HCIP 6400, HADM 6400, or HLTH 6471. A capstone course with synthesis and application of strategic planning, information technology, and analytic concepts via "real world" consultative projects grounded in health informatics and analytics.

HCIP 6260. Analytic Epidemiology. (3) Cross-listed Course(s): HLTH 6260 and PPOL 8665. Prerequisite(s): HLTH 6202 with a grade of B or above, and Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Principles and methods of studying advanced epidemiology, with emphasis on the analytic approach. Advanced techniques in the establishment of disease causation in groups and communities. Topics include: risk assessment, environmental exposures, stratification and adjustment, and multivariate analysis in epidemiology. Emphasis also placed on quality assurance and control and communicating results of epidemiological studies in professional publications and settings.

HCIP 6330. Medical Practice Management. (3) Cross-listed Course(s): HADM 6210. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. A comprehensive study of medical practice management and the issues, tools, and techniques to resolve those issues. Provides the student with an understanding of the financial and regulatory issues that influence today's medical practice with an insight into the cultural, human resource, and governance issues that make physician practices unique among healthcare organizations.

HCIP 6342. Health Information Technology Project Management. (3) Cross-listed Course(s): ITIS 6342. Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Introduces students to problems associated with managing information technology projects involving, particularly, integration of systems, development of client-specific solutions, and project justification. Moves beyond the classic techniques of project management and integrates communication software/systems, multi-site, multi-client facilities projects, cultural issues involved with managing interdisciplinary teams, and the effect of rapid technological obsolescence on project justification, funding and continuance.

HCIP 6350. Principles of Human-Computer Interaction. (3) Cross-listed Course(s): ITIS 6400. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and full graduate standing. Introduction to Human-Computer Interaction practice and research. Topics include: the perceptual, cognitive, and social characteristics of people, as well as methods for learning more about people and their use of computing systems. The process of interface design, methods of design, and ways to evaluate and improve a design. Also highlights a number of current and cutting-edge research topics in Human-Computer Interaction with a balance of design, sociological/psychological, and information systems elements.

HCIP 6380. Introduction to Health Informatics. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program, MPH program, or Graduate Certificate in Applied Nursing Informatics program. An introduction to fundamental terminologies, concepts, and techniques in health informatics. Exposes students to important and current topics, including electronic medical records (EMR), Electronic Health Records (EHR), health data and standards, sourcing, and analytics methods in administrative, clinical, and financial aspects of healthcare.

HCIP 6385. Healthcare Communication and Leadership. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing. Students critique and help revise each other's presentations and learn how to enhance communications. Students learn how to properly organize and run a meeting. Also covers negotiation, conflict management, and influence. Students use several

approaches to evaluate their individual leadership style. Completes a management style assessment, and analyzes leadership styles of prominent leaders in the eHealth environment, using contemporary leadership theory and principles. Primarily covers AHIMA HIM competency III.A.

HCIP 6390. Advanced Programming for Health Informatics. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Examines advanced use of object-oriented programming and scripting techniques applied to case studies in health informatics development. Emphasizes programming techniques beyond the fundamentals, with emphasis on efficiency in speed, data structures and file size. Students learn how to optimize code and databases so that the demands of large-scale health information systems can be performed in acceptable amounts of time while minimizing hardware requirements. Topics include: algorithm optimization, optimization of database queries and development for software as a service.

HCIP 6391. Architecting Health Information Systems. (3) Prerequisite(s): Enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Introduces planning, implementation, and maintenance of Health Information Systems for organizations. Students learn about the development of hardware and software requirements for system deployment, including: cost/benefit analysis, assessment of work-flow, interface, human resource factors, as well as capability assessment of regulatory requirements. Topics include: policy and procedure development for capability evaluation, regulatory compliance, system use, and data exchange.

HCIP 6392. Enterprise Health Information Systems. (3) Prerequisite(s): HCIP 6160; and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program, or MPH program. Provides graduate students with a comprehensive overview of information technology systems and applications commonly found in healthcare organizations. Topics include: (a) the history, evolution, state-of-art and issues of healthcare information systems; (b) the regulations, laws and standards applied to healthcare information systems; (c) the design and development principles (e.g., security and privacy) of health information systems; and (d) evaluation and adoption of clinical, administrative, and specialty information technology applications for health organizations of all sizes.

HCIP 6393. Health Data Integration. (3) Prerequisite(s): HCIP 6160 and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Provides a systematic understanding and experience of foundational concepts and techniques for data integration in healthcare. Topics include: heterogeneous data sources in healthcare, health data interoperability, health communications standards, health data standards, health data integration architecture, and health data integration models and techniques, including data preparation, health data integration tools, and health information exchange.

HCIP 6396. Business Intelligence in Healthcare. (3) Prerequisite(s): HCIP 5376 and HCIP 6380. Business Intelligence is a collection of computer-based techniques used to extract, identify and analyze data. Analytics is key in the transformation of the healthcare industry. Healthcare business intelligence can provide organizations with the ability to improve quality of care, increase financial efficiency and operational effectiveness, conduct innovative research, and satisfy regulatory requirements. Business Intelligence provides better access to information. It provides current and predictive views across the enterprise. Common functions of BI are reporting, data mining, analytical processing, knowledge management, and data visualization. Topics include: elements of business intelligence, business analytics, data visualization, data mining, data warehousing, and business performance management.

HCIP 6400. Health Informatics and Analytics Internship Project. (3) Prerequisite(s): HADM 6100; HCIP 6380; enrollment in M.S. in Health Informatics and Analytics program with a minimum of 12 program credit hours completed, including the designated prerequisites; and permission of instructor. Provides students who are at the midpoint of their M.S. in Health Informatics and Analytics program supervised hands-on experience in a healthcare setting. Students apply foundational knowledge in a field setting and reflect on their competence, career goals, and educational needs through a presentation and written report.

HCIP 6410. Personalization and Recommender Systems. (3) Cross-listed Course(s): ITIS 6410 and ITIS 8410. Prerequisite(s): Enrollment in the PSM or Graduate Certificate in Health Informatics and full graduate standing. An introduction to the application of personalization and recommender systems techniques in information systems. Topics include: historical, individual and commercial perspectives; underlying approaches to content-based and collaborative recommendation techniques for building user models; acceptance issues; and case-studies drawn from research prototypes and commercially deployed systems.

HCIP 6500. Complex Adaptive Systems. (3) Cross-listed Course(s): DSBA 6500, ITCS 6500, ITCS 8500, ITIS 6500, and ITIS 8500. Prerequisite(s): Permission of instructor, and enrollment in PSM or Graduate Certificate in Health Informatics and Analytics program. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open

(new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Covers the above and similar topics in an interactive manner. Examples of our current research effort are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity.

HCIP 6520. Network Science. (3) Cross-listed Course(s): DSBA 6520, ITIS 6520, and ITIS 8520. Prerequisite(s): Full graduate standing or permission of department. Network Science helps students design faster, more resilient communication networks; revise infrastructure systems such as electrical power grids, telecommunications networks, and airline routes; model market dynamics; understand synchronization in biological systems; and analyze social interactions among people. It examines the various kinds of networks (regular, random, small-world, influence, scale-free, and social) and applies network processes and behaviors to emergence, epidemics, synchrony, and risk. Integrates concepts across computer science, biology, physics, social network analysis, economics, and marketing.

HCIP 6800. Health Informatics and Analytics Independent Study. (1 to 3) Prerequisite(s): Enrollment in PSM in Health Informatics and Analytics program; and permission of instructor. Guided individual study in an issue related to health informatics and analytics arranged with a faculty member, or a supervised experience in a health analytics setting. *May be repeated with change of topic/deliverables up to 6 credit hours.*

History (HIST)

HIST 5000. Problems in American History. (3) Prerequisite(s): Permission of the department. A readings course designed around a problem in American history, requiring reading, discussion, reports and a major paper. *May be repeated for credit with change of topic.*

HIST 5001. Problems in European History. (3) Prerequisite(s): Permission of the department. A readings course designed around a problem in European history, requiring reading, discussion, reports and a major paper. *May be repeated for credit with change of topic.*

HIST 5002. Problems in Non-Western History. (3) Prerequisite(s): Permission of the department. A readings course designed around a problem in non-Western history, requiring reading, discussion, reports and a major paper. *May be repeated for credit with change of topic.*

HIST 5600. Research Seminar in History. (3) Cross-listed Course(s): HIST 4600. A research seminar course designed around a specific problem in History, requiring reading, discussion, reports and a major research paper. *May be repeated for credit with change in topic.*

HIST 5797. Honors Methods and Practice - Early Entry. (3) Cross-listed Course(s): HIST 4797. Prerequisite(s): HIST 2600, Departmental Honors, and Early Entry status. This course is open only to students pursuing both undergraduate honors and an Early Entry Master's degree. It is the first course in a required two-course sequence for Honors in History, and it substitutes for HIST 4797. It prepares students for the research and writing of an honors thesis by providing training in historiography, research methods, source development, and writing. During the course, students meet separately with their thesis advisor to craft their prospectus. Students must achieve a grade of A, or a grade of B with permission of instructor, to be able to take the next course in the sequence, HIST 4799 or HIST 5799. Students must achieve a grade of C to satisfy major requirements.

HIST 5799. Honors Research and Thesis - Early Entry. (3) Cross-listed Course(s): HIST 4799, Departmental Honors, and Early Entry status. Prerequisite(s): HIST 4797 or HIST 5797. This course is open only to students pursuing both undergraduate honors and an Early Entry Master's degree. It is the final course in a required two-course sequence for Honors in History. It involves the preparation and presentation of an acceptable Honors thesis or its equivalent. A grade of A is required to earn honors.

HIST 6000. Topics in History. (3) Prerequisite(s): Permission of the department. Intensive treatment of a period or broader survey of a topic, depending on student needs and staff resources. *May be repeated for credit with change of topic.*

HIST 6001. Colloquium in United States History Before 1865. (3) Prerequisite(s): Permission of the department. A reading colloquium focused on the major events and historiographical approaches in U.S. history to the Civil War.

HIST 6002. Colloquium in United States History Since 1865. (3) Prerequisite(s): Permission of the department. A reading colloquium focused on the major events and historiographical approaches in U.S. history since the Civil War.

HIST 6101. Colloquium in 19th-Century European History. (3) Prerequisite(s): Permission of the department. A reading colloquium focused on the major events and historiographical approaches in European history during the long 19th Century (1789-1914).

HIST 6102. Colloquium in 20th-Century European History. (3) Prerequisite(s): Permission of the department. A reading colloquium focused on the major events and historiographical approaches in European history from World War I to the late 20th Century.

HIST 6201. Colloquium in Colonial Latin American History. (3) Cross-listed Course(s): LTAM 6251. Prerequisite(s): Permission of the department. A topical colloquium devoted to selected themes in colonial Latin American history. Provides an introduction to research methods, documentary sources, and the critical analysis of historical literature. Topics will change. *May be repeated for credit.*

HIST 6202. Colloquium in Modern Latin American History. (3) Cross-listed Course(s): LTAM 6252. Prerequisite(s): Permission of the department. A topical colloquium devoted to selected themes in modern Latin American history. Provides an introduction to research methods, documentary sources, and the critical analysis of historical literature. Topics will change. *May be repeated for credit.*

HIST 6300. Topics in Public History. (3) Prerequisite(s): Permission of department. Intensive treatment of a field of public history, depending on student needs and staff resources. *May be repeated for credit with change of topic.*

HIST 6310. Museum Studies. (3) Prerequisite(s): Permission of the department. Introduces students to the management, curatorial, public relations, and fundraising aspects of historical museums and related historical sites. These skills are acquired through readings, term projects, and a "hands-on" experience at local museums and historical sites.

HIST 6320. Historic Preservation. (3) Prerequisite(s): Permission of the department. An introduction to the theory and practice of identifying, preserving and restoring buildings, sites, structures and objects in the historic built environment of the United States.

HIST 6330. History in the Digital Age. (3) Prerequisite(s): Permission of the department. Analyzes the impact of new media technology on the discipline of history as well as well as the ways in which new media enhances the discipline by making history accessible to a much broader audience. Involves a new media project that will require students to learn to work as a team, important to their preparation for careers in public history settings. Coursework includes common readings of texts and encounters with online studies, with emphasis on the media projects.

HIST 6400. Internship. (3) Prerequisite(s): Permission of the Director of Public History and faculty advisor. Completion of 145 hours of work as an intern, plus a journal and reflection paper.

HIST 6693. Historiography and Methodology. (3) Prerequisite(s): Six hours of graduate study in History and permission of the department. A study of historians and their philosophical and methodological approaches. Required of all M.A. candidates.

HIST 6694. Seminar in Historical Writing. (3) Prerequisite(s): HIST 6693 with grade of B or above, and permission of department. Seminar on the process of writing a history thesis, including evidence, argument, narrative, and organization. In this seminar, students write a thesis chapter or research paper. Required of all M.A. candidates.

HIST 6894. Readings in History. (3) Prerequisite(s): Prior written permission of instructor and Graduate Program Director. Coverage of historical periods or topics through individually designed reading programs; scheduled conference with a staff member. *May be repeated for credit.*

HIST 6901. Directed Readings/Research. (3) Prerequisite(s): Prior written permission of instructor and Graduate Program Director. Directed readings/research in conjunction with an undergraduate lecture course taught by a member of the Department of History graduate faculty. Students attend all lectures in the course and are expected to do additional graduate level reading and written work as assigned by the faculty member. This includes, but is not limited to, a 20-25 page paper.

HIST 6997. Directed Research. (3) Prerequisite(s): Prior written permission of instructor and Graduate Program Director. Investigation of a historical problem culminating in a research paper. *May be repeated for credit.*

HIST 6998. Exam Preparation. (3) Prerequisite(s): Permission of department. Preparation for comprehensive exams in three fields of historical study.

HIST 6999. Thesis. (3 or 6) Appropriate research and written exposition of research is required. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit by permission, if taken for three credit hours. Six credit hours of Thesis may be taken during a single semester.*

Public Health (HLTH)

HLTH 5000. Topics in Public Health. (3) Courses in selected topics and advanced studies in public health. *May be repeated for credit with change of topic.*

HLTH 5090. International Comparative Health Systems. (3) Cross-listed Course(s): HLTH 4090, NURS 6090, and SOWK 5126. A study tour to explore the cultures, social, and healthcare systems outside the United States. Participants visit a variety of healthcare sites and attend presentations by practitioners and educators. They have opportunities to interact with people from the host countries and visit a variety of cultural and historic sites.

HLTH 5126. Adolescent Sexuality and Family Life Education. (3) Designed for teachers, counselors, school nurses, administrators, and others responsible for family life education programs in school, with focus on adolescent sexuality issues.

HLTH 5206. Interprofessional Approaches to Suicide Prevention. (3) Prerequisite(s): Admission to Master of Public Health program or permission of instructor. Guided by suicide prevention and interprofessional (IPE) competencies, students are exposed to multi-level influences on suicide and its prevention. Topics include: suicide prevention-related ethical issues, terminology, attitudes and social norms, vulnerable populations, risk/protective factors, and mental health services and public health approaches to suicide prevention.

HLTH 6000. Special Topics in Public Health. (3) Courses in selected topics and advanced studies in public health. *May be repeated for credit with change of topic.*

HLTH 6101. International Health. (3) Principles and methods of studying international health, including historical background, sources and problems associated with health data, the social context, the role of government and non-government agencies, health in relation to environment and development, international health projects, defining the international health sector, infectious disease problems, and the practice of international health.

HLTH 6102. Environmental Health. (3) Prerequisite(s): Graduate standing. Contemporary environmental factors including biological, physical, and chemical factors which affect the health of a community. Traditional elements of environmental health, including the control of infectious diseases, toxicology, and environmental health policy and practices at local, state, and federal levels.

HLTH 6103. Maternal and Child Health Systems. (3) Prerequisite(s): Graduate standing. An overview of maternal and child health (MCH) service delivery systems at the federal, state, and local levels. Topics focus on the evidence-base for programs and funding mechanisms for the major programs for women, infants, and children. Attention is on levels of prevention and access to health services and programs, as well as the services and programs as a health system for vulnerable women, reproductive health, infants, and children. Analysis of the health systems considers the life course perspective, human development, health behavior and communication, and public policy.

HLTH 6104. Population Perspectives on Nutrition and Physical Activity. (3) Prerequisite(s): Enrollment in MPH or M.S. in Kinesiology, or permission of instructor. Students learn about common nutrition and physical activity recommendations and how they differ by gender and age, common measures used to assess population nutrition and physical activity, U.S. food and physical activity policy, global nutrition, and physical activity issues. Disparities in diet and physical activity behavior among various populations are also studied.

HLTH 6105. Gender and Sexual Health. (3) Prerequisite(s): Graduate standing. A survey of the dynamics of human sexuality and how it affects health, which includes the identification and examination of basic issues in human sexuality as relating to the larger society. It uses a life course perspective to examine changes over the course of the life span.

HLTH 6153. Worksite Health Promotion. (3) An exploration of the practices of promoting health in various settings for a variety of consumers.

HLTH 6155. Health Risk Reduction and Disease Prevention. (3) Personal/professional management of risk factors and lifestyle intervention processes for leading causes of mortality and morbidity.

HLTH 6200. Case Studies in Public Health. (3) Prerequisite(s): Graduate standing. Introduction to the diverse profession of public health, including the evolution and historical background of public health practice. Students learn the various paradigms that govern public health practice and the essential skills in critical thinking and group process needed to be effective in the field. Students also analyze a series of public health problems in the form of case studies using a watch, read, investigate, test/teach and evaluate (WRITE) technique.

HLTH 6202. Community Epidemiology. (3) Prerequisite(s): Enrollment in MPH program or permission of instructor. Principles and methods of epidemiology including definitions and models of health, illness and disease; modes of transmission of clinically important infectious agents; risk factors and chronic diseases; and insights into existing

studies and paradigms of health promotion and disease prevention.

HLTH 6211. Evidence-Based Methods in Public Health. (3)
Prerequisite(s): Enrollment in MPH program or permission of instructor. Introduction to basic concepts and principles of epidemiology and biostatistics with an emphasis on addressing public health problems in practical settings. Students develop skills to analyze public health data, using a statistical software package, such as STATA or SAS, and appropriate interpretation of results. Topics include: epidemiological study designs, descriptive epidemiological and statistical measures, standardization, measures of association and impact, sources of error, hypothesis testing, and stratified analysis.

HLTH 6212. Health Promotion Program Management. (3)
Prerequisite(s): Enrollment in MPH program or permission of instructor. An introduction to the public health core functions of: assessment, planning and assurance. Exposes students to concepts of cultural competence and introduce basics of budgeting. Students design, implement, and evaluate a brief, community-based public health intervention.

HLTH 6213. Policy and Leadership. (3) Prerequisite(s): Enrollment in MPH program or permission of instructor. Students examine and develop communication and leadership skills necessary for effective public health practice, including human resources management, conflict resolution, mediation and negotiation, community collaboration, and strategic planning. Students also develop an understanding of the role of law, policy, and advocacy in advancing the public's health and develop advocacy skills.

HLTH 6220. Applied Health Behavior Change. (3)
Prerequisite(s): Enrollment in MPH with Concentration in Community Health Practice or Physical Activity and Nutrition program, or permission of instructor. Introduction to important concepts and theories from the social and behavioral sciences that guide health promotion interventions targeted to changing health behaviors. Major public health problems such as health disparities, environmental risk factors, lifestyles choices that affect physical, mental, and social well-being, and problems with the organization and delivery of health services have both their origins and solutions in human behavior. Students synthesize the evidence-based health promotion literature, choose appropriate theoretical and behavioral measures to determine intervention success, and apply theory to intervention activities and programs.

HLTH 6225. Health Education and Health Promotion. (3)
Prerequisite(s): Graduate standing. Exposes students to principles, terminology, and strategies for health education in public health practice settings. Students apply and evaluate the use of health education delivery methods for various populations and community practice settings. They also explore the use of emerging technologies and social media in delivering and promoting health education. Students demonstrate how to design and communicate culturally tailored health information to a variety of audiences.

HLTH 6226. Community Health Methods. (3)
Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. A conceptual overview and detailed practical experience in the design and implementation of qualitative and quantitative methods in assessing, promoting, and assuring community health. Students learn and apply qualitative and quantitative methods to community health scenarios, including: in-depth interviewing, survey design and conduct, focus group discussion design and conduct, and analyzing measures. Students apply these skills to inform their understanding of the depth and breadth of community health issues.

HTLH 6227. Community Health Planning and Evaluation. (3)
Prerequisite(s): HLTH 6212; and enrollment in MPH with Concentration in Community Health Practice program or permission of instructor. Exposes students to the processes, techniques, and skills necessary to plan, to implement, and to evaluate programs related to public health. Students demonstrate their understanding of these principles and their ability to apply them in practice through the development and presentation of a comprehensive community needs assessment, a program proposal, and an evaluation plan. Particular emphasis is placed upon a social-ecological analysis of factors contributing to the understanding of, and response to, community health issues.

HLTH 6228. Social Determinants of Health. (3)
Prerequisite(s): Graduate standing. Exposure to broad social factors influencing population health: poverty, gender, economy, housing, immigration, urbanization, incarceration, technology, and others. These determinants differentially affect population subgroups influencing health status, health behavior, and healthcare utilization. Students investigate a particular social determinant and the relevant policies governing that issue in the form of a short paper. Students learn to write a concise and persuasive brief to advocate for change.

HLTH 6230. Community Health Practice Capstone. (3)
Prerequisite(s): Enrollment in MPH with Concentration in Community Health Practice or Physical Activity and Nutrition program. Pre- or Corequisite(s): HLTH 6471 or permission of instructor. The culminating, integrative curricular experience for students enrolled in the MPH program with a Concentration in either Community Health Practice or Physical Activity and Nutrition; students are

required to take this class during their last semester prior to graduation. The course draws on students' prior training in the core areas of public health; their additional required coursework in their concentration; and their field experience gained in their internship or service activities. The capstone course is closely linked to the MPH internship. It is designed to challenge students to reflect and integrate their training and experience with the goal of developing their own individual point of view regarding the role of public health, but also how each student sees him/herself fitting into public health practice.

HLTH 6260. Analytic Epidemiology. (3) Cross-listed Course(s): HCIP 6260 and PPOL 8665. Prerequisite(s): HLTH 6211; and enrollment in MPH program or doctoral program, or permission of instructor. Practical experience in preparing, analyzing, and presenting findings from epidemiologic data in the form of a research report or a manuscript. Students critically examine different epidemiologic research designs, identify sources of error, and develop skills to use bivariate and multivariate approaches to analyze epidemiologic associations. Students are introduced to sources of secondary datasets and use statistical software such as STATA, SAS to perform data analysis.

HLTH 6262. Public Health Data Analysis II. (3) Prerequisite(s): HLTH 6271; and enrollment in MPH or doctoral program, or permission of instructor. Provides the foundation skills for advance statistical methods used in the analysis of epidemiological and public health data. Emphasizes developing advanced data analysis skills using real life data. Topics include: multiple linear regression, logistic regression, Poisson regression, survey data analysis, and survival data analysis.

HLTH 6270. Epidemiologic Methods. (3) Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. Epidemiology is the study of distribution and risk factors of diseases, illnesses, and other health-related events in human population. This course is designed to further review the important concepts in epidemiologic research such as confounding, effect modification, and stratified analysis. Topics include: matching, screening, life table analysis, and survival analysis. Students gain expertise in critically reading current epidemiologic and medical literature.

HLTH 6271. Public Health Data Analysis. (3) Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. Prepares students for analysis and application of statistical methods used in epidemiologic research. After reviewing introductory concepts such as probability and probability distributions, descriptive statistics, and hypotheses testing, students are introduced to the advanced statistical methods such as multiple linear regression, logistic regression, survey data analysis, and survival data analysis. Statistical software such as STATA, SAS are used to perform data analysis.

HLTH 6273. Infectious Disease Epidemiology. (3) Prerequisite(s): HLTH 6211 and enrollment in MPH program or permission of instructor. Introduces the key concepts and basic research methods in infectious disease epidemiology. Students learn about causative agents, different routes of transmission (e.g., host-host, environmental transmission, vector-borne, etc.), outbreak investigation, and control/prevention strategies for a wide array of emerging and re-emerging infectious diseases, including HIV, Tuberculosis, malaria, etc. The difference between infectious and chronic diseases in epidemiological studies is also explored.

HLTH 6274. Chronic Disease Epidemiology. (3) Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. Explores the epidemiology of major chronic diseases in the U.S. and globally. Students are introduced to epidemiologic principles and methods as they apply to chronic disease problems. Students learn about surveillance, prevalence, incidence, and risk factors of major chronic diseases such as cancer, cardiovascular diseases, respiratory diseases, and diabetes. Students also learn how to analyze chronic disease outcomes using publicly available datasets such as NHANES, NHIS, and BRFSS.

HLTH 6275. Reproductive Epidemiology. (3) Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. The epidemiology of human reproductive function and conditions, diseases, and disorders that affect women and men of reproductive age. Methodological issues unique to reproductive epidemiology are explored, and students gain more expertise in critically interpreting relevant epidemiological literature.

HLTH 6276. Environmental and Occupational Epidemiology. (3) Prerequisite(s): HLTH 6211; and enrollment in MPH program or permission of instructor. The review of epidemiology methods as they relate to environmental and occupational epidemiology. A variety of topics are discussed, including study designs, validity and reliability, bias and confounding, measurement of exposure, and approaches to analyses. Topics are discussed in the context of specific health-related outcomes, such as cancer, respiratory diseases, reproductive outcomes, and neurological disorders. Emphasis is placed on identifying one or more environmental or occupational etiologic factors that are associated with these outcomes. Students obtain knowledge of course topics through formal lectures, assigned readings, class discussions, and exercises.

HLTH 6277. Nutritional Assessment and Epidemiology. (3) Prerequisite(s): Enrollment in MPH or M.S. in Kinesiology.

Designed for graduate students who are interested in conducting or better interpreting epidemiological studies relating diet and nutritional status to disease and health. There is an increasing awareness that various aspects of diet and nutrition may be important contributing factors in development of chronic disease. Topics include: 1) how to evaluate public health nutrition research studies; 2) the sources of available nutritional data; 3) the variety of nutritional measurement tools; and 4) how to identify appropriate nutritional measurement tools for a community-based assessment.

HLTH 6280. Epidemiology Capstone Course. (3)
Prerequisite(s): HLTH 6471 or permission of instructor, and enrollment in MPH with Concentration in Epidemiology program. A culminating experience designed for students to demonstrate their ability to integrate and apply knowledge and skills they have acquired through their prior training in the core areas of public health; epidemiology concentration coursework; and their field experience or service activities. Students work in small groups on public health problems to design and conduct field-based epidemiologic activities. Students are required to take this class during their last semester prior to graduation.

HLTH 6281. Measurement and Scale Development. (3)
Cross-listed Course(s): HLTH 8281. Prerequisite(s): Enrollment in MPH program. The conceptual aspects of quantitative measurement in the public health sciences and the practical aspects of the scale development process as applied to individual and population health status and behavioral and social determinant assessment. Students progress from a conceptual model of the health phenomenon under consideration to item development, response scaling, item selection, and scale development through reliability and validity testing. Students develop a framework for judging the appropriateness of a measure for a given situation.

HLTH 6361. Ethics in the Public Health Profession. (3)
Prerequisite(s): Enrollment in MPH program. Examines the ethical issues facing public health professionals working in public health practice, research, teaching, and service. Topics include: ethical issues in public health program implementation, research with vulnerable populations, data falsification and fabrication, plagiarism among students, ethics of working with students, publishing ethics, human subjects research, and working with the community.

HLTH 6471. Public Health Internship. (3) Prerequisite(s): Enrollment in MPH program, completion of 18 or more graduate credit hours, and permission of the MPH Program Director. Intensive, supervised experience in the practice of public health in community settings.

HLTH 6600. Seminar in Public Health. (1 to 6)
Prerequisite(s): Permission of instructor. Seminar in selected current topics and advanced studies in public health. *May be repeated for credit with change of topic.*

HLTH 6800. Tutorial in Public Health. (1 to 3)
Prerequisite(s): Permission of instructor. Directed study in areas of specialization in public health and related fields. Maximum credit toward degree: three hours. *Graded on a Pass/Unsatisfactory or IP basis.*

HLTH 8000. Special Topics in Public Health Sciences. (1 to 4) Courses in selected topics and advanced studies in public health sciences. *May be repeated for credit with change of topic.*

HLTH 8201. Introduction to Quantitative Research Design. (3) Cross-listed Course(s): HSRD 8260. Prerequisite(s): Enrollment in Ph.D. in Public Health Sciences program or permission of instructor. Pre- or Corequisite(s): Master's level Applied Biostatistics course or equivalent. An overview of quantitative methods as applied to design and analysis of public health and health services research problems. Topics include: categories and levels of quantitative research, characteristics of a good research design, relationship between theory and research, selection process for measurement tools, power analysis, sampling techniques, design sensitivity, and human subjects protection. An overview of qualitative research methods and their relationship to quantitative methods also are provided.

HLTH 8220. Theories and Interventions in Behavioral Science. (3) A broad overview of theories that influence health behavior and health outcomes using the social-ecological model as a guiding framework. Focus is less on learning specific theories, and more on how to apply theories in a health intervention. Students read a variety of articles related to intervention research and identify issues that could form potential avenues of theoretical and intervention inquiry. The major emphasis is on designing a health behavior intervention using theory and writing a complete grant proposal detailing the intervention.

HLTH 8221. Qualitative Research in Behavioral Sciences. (3) Prerequisite(s): Enrollment in Ph.D. in Public Health Sciences program or permission of instructor. Introduction to qualitative research design, data generation techniques, and analyses that lead to theory generation and identification of theoretical concepts. Students learn the philosophical basis of qualitative research, basic qualitative research designs, gain an understanding of qualitative research elements that must be addressed in a research project, and the importance of research rigor. The course explores both theoretical and practical dimensions of qualitative data collection and analyses, including identifying themes, developing and using codebooks,

making systematic comparisons, and writing qualitative methods and results. Students will be introduced to qualitative analysis software for coding and managing qualitative data, and collaborate in the process of transforming qualitative data into analyses and interpretations.

HLTH 8222. Qualitative Research II: Theory Generation and Analysis in Behavioral Sciences. (3) Pre- or Corequisite(s): HLTH 8221. Using data collected in HLTH 8221, students work in teams to analyze data from various techniques and perspectives including grounded theory to develop robust and bounded concepts. The focus is on analyzing and writing qualitative research to contribute to theory development. Students learn how to write a qualitative article for publication. Additional assignments include: developing a code book, analyzing text data using grounded theory techniques of constant comparison, presenting findings back to your community partner agency, and writing a qualitative methods section of a research manuscript.

HLTH 8223. Social Determinants of Health. (3) The major social determinants of health using the social-ecological model as a guiding framework. Focus is on how differences in levels of these determinants contribute to health inequalities and poor health. Students read across disciplines and international boundaries to gain a broad understanding of social determinants. Students write a literature review paper addressing a key social determinant and how it influences health behavior and a corresponding health outcome.

HLTH 8270. Applied Biostatistics: Regression. (3) Pre or Corequisite(s): Graduate level Introduction to Biostatistics or approved Statistics course; basic knowledge of statistical software; or permission of the instructor. To understand and apply concepts and principles of regression-based statistical methods, including linear regression, logistic regression, count regression, survival analysis, and longitudinal data analysis to health related studies. Students use statistical software for computation and develop skills for selecting appropriate methods for data analysis and interpreting the results of health-related studies in scientific and nontechnical language.

HLTH 8271. Applied Biostatistics: Multivariate Methods. (3) Prerequisite(s): HLTH 8270 or permission of instructor. An intermediate course that covers biostatistical principles and methods for analyzing discrete and continuous multivariate data: correlations, discriminant analysis, factor analysis, multivariate analysis of variance, log-linear models for contingency tables, multilevel modeling, comorbidity and competing risks, and regression methods for multivariate dependent data, such as time series and spatial data. Statistical software is used for data analysis.

HLTH 8281. Measurement and Scale Development. (3) Cross-listed Course(s): HLTH 6281. Pre- or Corequisite(s): HLTH 8201. The conceptual aspects of quantitative measurement in the public health sciences and the practical aspects of the scale development process as applied to individual and population health status and behavioral and social determinant assessment. Students progress from a conceptual model of the health phenomenon under consideration to item development, response scaling, item selection, and scale development through reliability and validity testing. Students develop a framework for judging the appropriateness of a measure for a given situation.

HLTH 8282. Health Survey Design and Research. (3) Pre- or Corequisite(s): HLTH 8201. The practical aspects of designing (or selecting) quantitative survey instruments related to health status assessment in individuals and populations and their use in research. Building upon prior coursework and drawing upon case studies and practical exercises, students progress from appropriately formulating questions (items) for a variety of domains to the design and layout of survey instruments and the development of survey protocols through the data entry, data cleaning, and analysis/reporting phases.

HLTH 8600. Seminar in Public Health Sciences. (1 to 6) Pre- or Corequisite(s): Permission of instructor. Seminar in selected current topics and advanced studies in public health. *May be repeated for credit with change of topic.*

HLTH 8601. Ethics and Integrity in Health Research and Practice. (3) Examines the ethical and integrity issues health professionals may face in research, practice, teaching, and service. Topics include: responsible human and animal subjects research, including research with vulnerable populations and communities, data falsification, and fabrication; ethical issues in health program implementation; professional ethics; plagiarism; publishing ethics; and interactions with students. Fulfills the GRAD 8302 requirement.

HLTH 8602. Communicating and Disseminating Research. (1) Prerequisite(s): Enrollment in Ph.D. in Public Health Sciences program or permission of instructor. Focuses on research dissemination planning, writing for publication, presenting at professional conferences, presenting to the community, writing technical reports for funders, writing abstracts, and working with the media. Students work on a variety of assignments to gain skills related to disseminating research in different venues. *Graded on a Pass/Unsatisfactory basis.*

HLTH 8603. Teaching Portfolio. (3) Teaching strategies that focus on the major aspects of university teaching. Topics include: preparing a syllabus, creating assignments, evaluating student performance, and enhancing student

learning through the use of various discussion and lecture techniques. Students work with a faculty member to develop and deliver a lecture, and develop and grade an assignment to assess students' understanding based on the delivered lecture.

HLTH 8800. Independent Study in Public Health Sciences. (1 to 6) Pre- or Corequisite(s): Full graduate standing in the PhD in Public Health Sciences program and permission of instructor. Guided individual study in topics or issues related to public health sciences arranged with a faculty advisor. *Graded on a Pass/Unsatisfactory or IP basis. May be repeated for credit.*

HLTH 8901. Dissertation Research. (3, 6, or 9) Pre- or Corequisite(s): Passing the Ph.D. in Public Health Sciences comprehensive exam and approval of the Dissertation Chair. Individual investigation that culminates in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit up to 18 credit hours for degree.*

Health Psychology (HPSY)

HPSY 8050. Topics in Psychological Treatment. (3) Cross-listed Course(s): PSYC 6050. A topical course which focuses on issues in treatment, alternative treatment perspectives, special client populations. *May be repeated for credit with permission of department.*

HPSY 8099. Topics in Psychology. (3) Cross-listed Course(s): PSYC 6099. A discussion of selected topics in psychology. *May be repeated for credit with change of topic.*

HPSY 8102. Research Design and Quantitative Methods in Psychology. (3) Cross-listed Course(s): OSCI 8102. Prerequisite(s): Admission to the Ph.D. in Health Psychology program, or permission of instructor. This interdisciplinary course provides a broad overview of the major research methodologies and methodological considerations in the behavioral sciences. Using examples drawn from the literature, the course focuses on general principles and perspectives of social science research. Topics include: foundational concepts across the behavioral sciences (e.g., sampling, measurement, ethics, logic of hypothesis testing, etc.), and the evaluation of specific methodologies (e.g., experimentation, observation, survey, archival, epidemiological/ecological designs, etc.). Practical research considerations are also covered (e.g., basics of APA writing, IRB process and forms, data management and data cleaning, development of experimental protocols, etc).

HPSY 8103. Basic Quantitative Analyses for Behavioral Sciences. (3) Cross-listed Course(s): OSCI 8103. Prerequisite(s): HPSY 8102. Introduction to quantitative data analysis and interpretation. Focuses on the strategic application of the multiple regression and correlational framework (including specific instantiations such as ANOVA, path analyses, etc.) including the incorporation of manipulated or categorical independent and categorical dependent variables.

HPSY 8104. Advanced Quantitative Analyses for Behavioral Sciences. (3) Cross-listed Course(s): OSCI 8104. Prerequisite(s): HPSY 8103 or equivalent; admission to the Ph.D. in Health Psychology program; or permission of instructor. A topical course that focuses on selected advance quantitative analyses used within behavioral sciences. Topics may include: survival analysis, repeated measures analyses, latent model analyses, multi-level modeling, advanced categorical variable analyses, meta-analysis. *May be repeated for credit with change of topic.*

HPSY 8107. Ethical and Professional Issues in Psychology. (3) Cross-listed Course(s): PSYC 6107. Roles and responsibilities of psychologists, including ethical standards in professional practice, testing and research; expectations and problems confronting psychologists in industrial, clinical and professional organizations.

HPSY 8141. Intellectual Assessment. (4) Cross-listed Course(s): PSYC 6141. Theories of intelligence and methods of intellectual assessment, including practice in administering intelligence tests, interpreting results, and writing evaluation reports. Three lecture hours and one two-hour lab per week.

HPSY 8142. Personality Assessment. (4) Cross-listed Course(s): PSYC 6142. Prerequisite(s): HPSY 8141, HPSY 8151, or permission of department. Theories and methods used in the assessment of personality and psychopathology, including practice in administering personality tests, interpreting results and writing evaluation reports. Three lecture hours and one two-hour lab per week.

HPSY 8145. Applied Research Design and Program Evaluation. (3) Cross-listed Course(s): PSYC 6145. Prerequisite(s): PSYC 6102. Models of evaluative research; also techniques, designs and administration of program evaluation. Topics include: role conflicts, entry issues, goal setting, research for program planning and implementation and examples of actual program design and evaluation.

HPSY 8150. Introduction to Psychological Treatment. (4) Cross-listed Course(s): PSYC 6150. Prerequisite(s): HPSY 8151. Major approaches to psychological intervention, including psychodynamic, behavioral, humanistic and cognitive-behavioral systems. Emphasis on practical

therapy considerations, including crisis intervention, client behaviors at various stages of therapy, handling difficult clients and ethical and professional issues. Three lecture hours and one two-hour lab per week.

HPSY 8151. Behavior Disorders. (4) Cross-listed Course(s): PSYC 6151. Diagnostic systems in current use and the implications of these systems for psychologists; several perspectives on psychological processes, behavior disorders and diagnosis including psychodynamic, behavioral and social models; practice in diagnostic interviewing. Three lecture hours and one two-hour lab per week.

HPSY 8155. Community Psychology. (3) Cross-listed Course(s): HPSY 8155. Research, intervention techniques and settings associated with major approaches in community psychology including the mental health, organizational, ecological, and social action models.

HPSY 8200. Health Psychology I. (3) Cross-listed Course(s): PSYC 6200. Prerequisite(s): Admission to the Ph.D. program in Health Psychology or permission of instructor. Intensive review of the contributions of the discipline of psychology to the promotion and maintenance of health, the prevention and treatment of illness, and the examination of health behaviors. Presents an historical overview of psychosomatic medicine and behavioral medicine. Focuses on biological, cognitive, affective, social and developmental approaches to health and illness experiences. Topics include: stress, coping, adherence to treatment, pain, chronic disease, psychoneuroimmunology and health behavior changes among others. Emphasizes the biopsychosocial model in understanding health and disease.

HPSY 8201. Health Psychology II. (3) Cross-listed Course(s): PSYC 6202. Prerequisite(s): HPSY 8200. Continuation of Health Psychology I.

HPSY 8240. History and Systems of Psychology. (3) Prerequisite(s): Graduate standing and permission of instructor. Explores major developments and ideas in the discipline of psychology from its founding in the late 19th century through the early 21st century. Consideration of the systems of psychology, past and present; major controversies and their relevance to contemporary psychology; and the relation between psychology and other disciplines.

HPSY 8243. Diversity in Health Psychology. (3) Prerequisite(s): Doctoral student standing. This course covers the central ideas and theories related to the role of culture, gender, and socioeconomic status in influencing behavior, cognitions, and emotions as they relate to physical and mental health outcomes. The materials reviewed examine the importance of considering the role of these factors in research, prevention intervention efforts, treatment, and the delivery of health services.

HPSY 8245. Clinical Supervision and Consultation in Psychology (3). Prerequisite(s): doctoral graduate standing or permission of instructor. Explores major theories, approaches, and techniques in clinical supervision and consultation in professional psychology. Students are provided with the knowledge and skills necessary to work as effective clinical supervisors and psychological consultants.

HPSY 8255. Community Interventions. (3) Cross-listed Course(s): PSYC 6255. Prerequisite(s): HPSY 8155 and doctoral student standing. Intensive review of the use of system- and organizational-level interventions to promote and maintain health, prevent illness, and improve quality of life. Presents an historical overview of the effectiveness of different types of interventions, and theoretical and empirical background regarding the conditions and factors that contribute to successful community interventions. Students develop and implement a community intervention, in collaboration with a local organization, and develop a grant proposal that would fund a community intervention.

HPSY 8260. Topics in Health Psychology. (3) Cross-listed Course(s): PSYC 6260. Prerequisite(s): HPSY 8200. An examination of selected topics in Health Psychology. *May be repeated for credit with permission of department.*

HPSY 8262. Practicum in Health Psychology. (1 to 3) Cross-listed Course(s): PSYC 6262. Prerequisite(s): HPSY 8200 and permission of the department. Experience in assessment and treatment with clients at local health agencies under supervision from a faculty member on campus. Applications of the principles of health psychology to special problems with in a healthcare organization or setting. *May be repeated for credit with permission of department.*

HPSY 8450. Practicum in Clinical Psychology. (1 to 3) Cross-listed Course(s): PSYC 6450. Prerequisite(s): HPSY 8150 and permission of department. Experience in clinical assessment and/or psychotherapy with clients at local agencies under supervision from a faculty member on campus. *May be repeated for credit with permission of department.*

HPSY 8455. Practicum in Community Psychology. (1 to 3) Cross-listed Course(s): PSYC 6455. Applications of the principles of community psychology to special problems within an organization or community setting. The project might include, but would not be limited to, consultation, program development, training, community education or program evaluation. *May be repeated for credit with permission of department.*

HPSY 8601. Foundations in Psychology I: Physiological, Cognitive, and Affective Basis of Human Behavior. (3)
Prerequisite(s): Enrollment in Ph.D. in Health Psychology program or permission of program. Provides foundational knowledge, as required by the APA Commission on Accreditation, for graduate training in professional psychology, with a specific focus on the areas of physiological psychology, cognitive psychology, and affective foundations. Each content area is covered in a 5-week module with additional integrative content and assignments spanning the semester.

HPSY 8602. Foundations in Psychology II: Developmental, Community, and Social Basis of Behavior. (3)
Prerequisite(s): Enrollment in Ph.D. in Health Psychology program. Introduces the fields of developmental, community, and social psychology. Explores the lifespan, contextual, and social/group perspectives on health and well-being and investigate how health and well-being are shaped by longitudinal and contextual factors across ecological levels.

HPSY 8899. Readings and Research in Psychology. (1 to 4)
Cross-listed Course(s): PSYC 6899. Prerequisite(s): Permission of instructor and department to be obtained in the semester preceding the semester in which the course is to be taken. Individual study in psychology which may take the form of conducting empirical research or formulating a critique and synthesis of existing research. *May be repeated for credit.*

HPSY 8950. Internship. (0) Prerequisite(s): Good standing in the program, completed all relevant coursework, successfully completed comprehensive examinations (clinical and programmatic), successfully proposed doctoral dissertation, and approval by the Director of Clinical Training. Placement in a pre-doctoral clinical internship at an American Psychological Association approved site or at another site approved by the Director of Clinical Training. Internship typically lasts for one continuous year. Enrollment in this cooperative course represents full-time enrollment. *Grading on a Pass/Unsatisfactory basis. May be repeated over a one year period.*

HPSY 8999. Doctoral Dissertation Research. (1 to 9)
Prerequisite(s): Admission to Ph.D. in Health Psychology program, satisfactory completion of comprehensive examination, and approval of research topic by dissertation committee. Execution of original research that culminates in the preparation and presentation of a doctoral dissertation in a topic of health psychology. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Health Services Research (HSRD)

HSRD 8000. Topics in Health Services Research. (1 to 4)
Prerequisite(s): Full graduate standing in the Ph.D. in Health Services Research program or permission of the instructor. Study of selected topics in health services research. *May be repeated for credit. Graded on a Pass/Unsatisfactory basis.*

HSRD 8201. Introduction to Health Services Research. (3)
Introductory course in models, theoretical frameworks and key components of health services research. Historical development of health services research will be traced. An in-depth study of social determinants of health will be explored.

HSRD 8202. Healthcare Systems and Delivery. (3)
Prerequisite(s): Enrollment in the Ph.D. in Health Services Research program or permission of the instructor. Provides a theoretical and empirical basis for understanding major organizational, delivery, and financing structures and related health outcomes comprising present day healthcare in the United States and globally. Evidence from health services research studies is discussed as part of the identification of key areas for future research.

HSRD 8203. Economics of Health and Healthcare. (3)
Cross-listed Course(s): ECON 6260 and PPOL 8667. Prerequisite(s): Enrollment in the interdisciplinary Ph.D. in Health Services Research program or the Ph.D. in Public Policy program, or permission of the instructor. Uses economic theory and econometrics to analyze the functioning of the healthcare sector and appropriate public policy. Topics include: how markets for medical care differ from other markets, the demand for medical care, the demand and supply of health insurance, the role of competition in medical markets, managed care, managed competition, and the role of the public sector in regulating and financing healthcare. The topic list is flexible and student input is solicited and welcomed.

HSRD 8204. Health Policy. (3) Cross-listed Course(s): PPOL 8663. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy or Health Services Research programs and a graduate level course providing an adequate introduction to the U.S. healthcare system such as HADM 6100, MPAD 6172, or permission of instructor. Examines the formulation, adoption, implementation, and evaluation of health policy at national, state, and local levels through extensive readings in relevant health and policy literatures.

HSRD 8260. Design of Health Services Research. (3)
Cross-listed Course(s): HLTH 8201. Prerequisite(s):

Enrollment in Ph.D. in Health Services Research program or permission of instructor. Pre- or Corequisite(s): Master's level Applied Biostatistics course or equivalent. An overview of quantitative and qualitative methods as applied to design and analysis of health services research problems. Qualitative topics: overview of philosophies of qualitative inquiry, characteristics of qualitative research design, managing qualitative data, and qualitative methods. Quantitative topics: categories and levels of quantitative research, characteristics of a good research design, relationship between theory and research, selection process for measurement tools, power analysis, sampling techniques, design sensitivity, and human subject protection.

HSRD 8261. Healthcare Program Evaluation, Outcomes, and Quality. (3) Prerequisite(s): Enrollment in the Ph.D. in Health Services Research or Ph.D. in Public Health Sciences programs, or permission of instructor. Corequisite(s): HLTH 8270 or permission of instructor. Introductory course in evaluation research in healthcare settings. Emphasis is on conceptual, methodological, organizational, political, and ethical problems in evaluating programs. Tasks of identifying quality and outcome indicators, choosing methods, assessing feasibility, assuring quality data, addressing population and program diversity, project management, and incorporating context into reports of findings are also examined.

HSRD 8262. Large Data Sets and Health Services Research. (3) Prerequisite(s): HLTH 8270 and enrollment in the Ph.D. in Health Services Research program or Ph.D. in Public Health Science programs, or permission of instructor. Addresses the evaluation of healthcare quality and outcome measures through secondary data analysis of large health services data sets. Methodological issues and solutions related to secondary analysis are discussed. Statistical techniques and approaches commonly used in health services research are explored. including adjustment for confounding/endogeneity, missing data, transformations of data, risk adjustment, and time-fixed and time-dependent study designs.

HSRD 8263. Advanced Data Analysis for Health Services Research. (3) Prerequisite(s): Enrollment in the Ph.D. in Health Services Research program or permission of the instructor. Provides applied skills that enable students to efficiently conduct advanced health services research with complex and multiple health-related databases.

HSRD 8600. Seminar in Health Services Research. (1) Prerequisite(s): Enrollment in the Ph.D. in Health Services Research or Ph.D. in Public Health Sciences programs, or permission of instructor. This seminar style forum exposes students to a variety of health services research applications through presentation and critique of original research. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit up to four times.*

HSRD 8604. Seminar in Health Disparities. (1) Prerequisite(s): Enrollment in the Ph.D. in Health Services Research or Ph.D. in Public Health Sciences programs, or permission of instructor. A review of current research documenting disparities and an examination of research designs and methods sensitive to cultural issues in health research. Study includes work from a variety of disciplinary perspectives. *Graded on a Pass/Unsatisfactory basis.*

HSRD 8605. Seminar in Grant Proposal Writing. (1) Prerequisite(s): Enrollment in Ph.D. in Health Services Research or Ph.D. in Public Health Sciences programs, or permission of instructor. Pre- or Corequisite(s): HSRD 8262. An overview of the grant writing process, including types of funding organizations/programs and grant mechanisms. Students gain skills in writing an effective research proposal and learn about the peer review process and scoring of grants. *Graded on a Pass/Unsatisfactory basis.*

HSRD 8612. Seminar in Grant Proposal Writing. (3) Prerequisite(s): Enrollment in the Ph.D. in Health Services Research program or permission of the instructor. Seminar to develop a grant proposal using existing funding mechanisms from governmental or private funding agencies. This course uses a step-wise approach to writing all major sections of a grant proposal. Proposal development familiarizes students with governmental guidelines, grant submissions and the peer review process.

HSRD 8800. Independent Study in Health Services Research. (1 to 6) Prerequisite(s): Full graduate standing in the Ph.D. in Health Services Research program or permission of the instructor. Guided individual study in topics or issues related to health services research arranged with a faculty advisor. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

HSRD 8884. Seminar in Research Implementation and Dissemination. (1) Pre- or Corequisite(s): Passed comprehensive examination and enrollment in Ph.D. in Health Services Research Program. Seminar on implementation of a funded research project. The infrastructure for successful implementation and reporting is discussed with specific examples. Pitfalls in technology, communication, natural history of a study and budgeting are also discussed. Case studies based on studies by faculty are used to illustrate the range of approaches to the research process. Students develop an application to present and a manuscript for publication. *Graded on a Pass/Unsatisfactory basis.*

HSRD 8901. Dissertation Research. (3, 6, or 9)
Prerequisite(s): Passage of qualifying examination and approval of the Dissertation Chair. Under the direction of a dissertation chair and committee, students are expected to design and execute an original research study. This study should address a significant problem or issue related to health services research. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit up to 18 credit hours.*

Infrastructure and Environmental Systems (INES)

INES 8090. Topics in Infrastructure and Environmental Systems. (3) Selected topics in civil and environmental engineering, earth sciences, engineering management, biology, chemistry, economics, or public policy. May be cross-listed with advanced graduate courses offered by respective departments. *May be repeated for credit.*

INES 8101. Environmental Systems. (3) Prerequisite(s): Admission to Ph.D. in Infrastructure and Environmental Systems program. Examines the principles of energy and mass transport as applied to the atmosphere, hydrosphere, lithosphere and the Earth's biogeochemical systems and how these impact human activities and infrastructure. Emerging environmental issues and technologies in the areas of environmental impact due to human activities and natural disasters, and environmental sustainability including industrial ecology, waste minimization and recycling, will also be examined.

INES 8102. Infrastructure Systems. (3) Prerequisite(s): Admission to Ph.D. in Infrastructure and Environmental Systems program. Overview of urban infrastructural development. Sustainable design features for facilities, including municipal, transit, industrial, agricultural, telecommunications, and waste management. Impact of infrastructure development on environmental management, including storm water quality and quantity, soil and channel erosion, urban air quality, sprawl, and waste production, treatment, and storage.

INES 8104. Advanced Infrastructure Systems. (3)
Prerequisite(s): Admission to Ph.D. in Infrastructure and Environmental Systems program. Study of the inter-relationship between urban infrastructure systems and the natural environment. Concepts pertaining to sustainability, resilience, climate change and adaptation, environmental quality, smart technology, asset management, decision support, economics and policy are reviewed and tailored to research on contemporary issues and emerging technologies. Students are expected to apply the principles and fundamentals in their specific fields of sciences and engineering.

INES 8110. Acquisition and Analysis of Scientific Data. (3)
Prerequisite(s): Admission to Ph.D. in Infrastructure and Environmental Systems program. The study of theories and techniques for acquiring and analyzing scientific data and information related to the analysis, design and management of the infrastructure and the environment. Includes pertinent aspects of data analysis such as statistical analysis, uncertainty, detection limits, correlation methods, trend analysis, and data management/warehousing. Includes applications of GIS and non-destructive assessment technologies to data acquisition.

INES 8113. Case Study. (1 to 3) Prerequisite(s): INES 8101 and INES 8102. Students work together on interdisciplinary teams to study relevant environmental and infrastructure problems presented through case studies. The intent of the course is to directly involve the students in ongoing urban community projects. *May be repeated for credit.*

INES 8120. Numerical Modeling of the Earth System. (3)
Cross-listed Course(s): ESCI 6120. Focuses on fundamental principles and applications of numerical modeling in simulating components of the Earth system, including the atmosphere, land, and water. Philosophical considerations of why and how numerical models and model output are used in the Earth sciences are discussed. Also delves into the technical details of constructing a model, including finite differencing, boundary conditions, and parameterizations, and how these choices influence model output.

INES 8201. Environmental and Ecological Economics. (3)
Prerequisite(s): permission of instructor. Students explore the ways in which ecosystem services are measured, valued, and monetized by the society. The course is divided into three lecture modules: (a) environmental economics, (b) risk analysis and management, and (c) ecosystem services and valuation. It is appropriate for advanced graduate students with background in engineering, environmental sciences, business, and public policy.

INES 8202. Renewable Energy. (3) Restriction(s): Permission of instructor. Study of technological and system advances in conventional and renewable energies, including system integration, storage, economics, policy, and environmental and health impacts. Emphasis is given to application of renewable energy for the transportation and electric power industries. Students are expected to complete a project or research paper on renewable energy assessment and implementation.

INES 8222. Quaternary Paleoenvironmental Sciences. (3)
Cross-listed Course(s): ESCI 6222, GEOG 6222, and GEOG 8222. A multi-disciplinary course which surveys methods

used to reconstruct past climates, past environments and past landscapes during the Quaternary period. Changes in past environmental conditions are discussed in light of present and future landscape predictions emphasizing both natural and human causes. Focuses on biotic and abiotic material from terrestrial and marine sediment cores, ice cores, and other proxies for past environments and past climates.

INES 8227. Ecosystem Restoration. (3) Cross-listed Course(s): ESCI 6227, GEOG 6227, and GEOG 8227. Ecosystem restoration has long been used as a method to return the natural structure and function to degraded ecosystems. This course examines the theory and methods used in restoration with a focus on both terrestrial and freshwater ecosystems. Focuses on the science and policy of ecosystem restoration and uses examples from ecosystems around the world.

INES 8229. Geochemical Tracers and Hydrologic Applications. (3) Cross-listed Course(s): ESCI 6229, GEOG 6229, and GEOG 8229. Examines environmental tracers in surface and subsurface hydrology (streams, lakes, and groundwater) using an applied approach. Tracer techniques include geochemical element fingerprinting, stable isotopes, and residence time estimation.

INES 8690. Seminar. (1) Prerequisite(s): Admission to Ph.D. in Infrastructure and Environmental Systems program. Students are required to actively participate in program seminars delivered by student researchers, faculty and invited speakers. These seminars are advertised to the campus and professional communities. Participation in these seminars count for a total of 3 credits (1 credit for each semester). Prior to graduation, each student makes at least one seminar presentation and provides at least one formal critique of a presentation. *May be repeated for credit.*

INES 8890. Doctoral Independent Study and Project. (1 to 9) Individual investigation and exposition of results. *May be repeated for credit.*

INES 8998. Doctoral Research. (1 to 9) Prerequisite(s): INES 8999. Students continue individual investigations culminating in research and the preparation of scholarly publications upon completing the 18 credit hour maximum of INES 8999. Credit hours earned will not be counted toward curriculum requirements. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

INES 8999. Doctoral Dissertation Research. (1 to 9) Students initiate and conduct individual investigations culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit up to 18 credit hours.*

Business Information Systems (INFO)

INFO 8100. Information Systems Research Methodologies. (3) Prerequisite(s): Graduate standing or permission of the instructor. A study of statistical and research methods used in information systems research.

INFO 8120. Advanced Research Methodologies. (3) Prerequisite(s): INFO 8100 or permission of department. A study of advanced research methods used in business administration and management information systems research.

INFO 8201. Data and Knowledge Management in Business. (3) Prerequisite(s): MBAD 5121 or permission of department and admission to the Ph.D. in Computing and Information Systems Program. An overview of the business approach to identifying, modeling, retrieving, sharing, and evaluating an enterprise's data and knowledge assets. Covers the organizational, technological and management perspectives.

INFO 8202. Business Information Systems: Analysis, Design, and Management. (3) Prerequisite(s): MBAD 5121 or permission of department. Examination of managerial issues associated with the study of business processes and the development of supporting information systems. Emphasis on the application of appropriate methodologies, techniques, and tools to analyze, design, and implement business information systems. Study of relevant IS project management and quality assurance techniques.

INFO 8203. Information Systems Economics, Strategy and Policy. (3) Prerequisite(s): MBAD 5121 or permission of department and admission to the Ph.D. in Computing and Information Systems Program. Examines a collection of topics that deal with the strategic use of information systems (IS). These topics include Business Value of IS, Network Economics, use of IS for competitive advantage, IS Planning and policy setting, IS evaluation, selection and sourcing.

INFO 8204. Business Data Communications. (3) Prerequisite(s): MBAD 5121 or permission of department. Examination of the information communication requirements of business environments, the fundamentals of communication technology, and the application of the technology for solving business problems. Emphasis on understanding communication technologies to assess needs, plan for the introduction of hardware and software, and manage these communication systems.

INFO 8700. Advanced Topics in MIS. (3) Prerequisite(s): Permission of department. Topics in MIS selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

INFO 8800. Information Systems Research Seminar. (3) Prerequisite(s): INFO 8100 or permission of department. A study of current research areas in MIS.

INFO 8900. Directed Individual Study in Business Information Systems. (3) Prerequisite(s): Permission of department and member of the doctoral faculty who would direct the study. Directed individual study and in-depth analysis of a special area of MIS. The course may be used to satisfy up to six credit hours of graduate credit requirements in the Ph.D. in Computing and Information Systems degree program. *May be repeated for credit with different area of study.*

Interpreting (INTE)

INTE 5050. Topics and Practicum in Interpreting. (3) Selected topics in Interpreting and Interpreting Studies. May include practice in interpreting a variety of languages. *May be repeated for credit with change of topic.*

INTE 6050. Topics in Interpreting Studies. (3) Selected topics in field of interest related to various theoretical and practical aspects of interpreting and interpreting studies. *May be repeated for credit with change of topic.*

INTE 6172. Spanish-English Legal Interpreting. (3) Explores the sociolinguistic, legal, ethical, and pragmatic dimensions of legal interpreting. Also reviews legal terminology in the Spanish-English language combination and develops skills in sight translation, consecutive interpreting, and simultaneous interpreting in a variety of legal settings. *May be repeated for credit with change of topic.*

INTE 6174. Spanish-English Medical Interpreting. (3) Explores the sociolinguistic, legal, ethical, and pragmatic dimensions of medical interpreting, as well as healthcare literacy, cross-cultural communication, and intercultural competency. Also reviews medical terminology in the Spanish-English language combination and develops skills in sight translation, consecutive interpreting, and simultaneous interpreting in a variety of medical settings. *May be repeated for credit with change of topic.*

INTE 6176. Spanish-English Community Interpreting. (3) Explores the sociolinguistic, legal, ethical, and pragmatic dimensions of community interpreting in a variety of settings, such as educational and social work. Also reviews relevant terminology in the Spanish-English language combination and develops skills in sight translation, consecutive interpreting, and simultaneous interpreting in these settings. *May be repeated for credit with change of topic.*

INTE 6601. History, Theory, and Method of Interpreting. (3) Explores representative topics, movements, and texts in the history, theory, and method of interpreting, traces the development of the discipline, and introduces the practice of interpreting in three different modes: sight translation, consecutive, and simultaneous. *May be repeated for credit with change of topic.*

Computer Science (ITCS)

ITCS 5010. Topics in Computer Science. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Topics in computer science selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters.

ITCS 5102. Survey of Programming Languages. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Study of the concepts underlying various computer languages, and comparing and evaluating various language features. History and development of various languages, such as FORTRAN, ALGOL, PASCAL, MODULA-2, C, C++, Ada, Lisp, Smalltalk, Prolog.; evaluation and comparison of various algorithms and language suitability. Selection of languages for problems/environments. Overview of various languages.

ITCS 5111. Introduction to Natural Language Processing. (3) The practical methods and techniques of natural language processing and text mining. These techniques, mainly the techniques of syntactic and semantic processing, are illustrated with specific tasks (such as: Information Extraction, Dialogue Systems, Information Retrieval, etc.). Most programming assignments are for the laptop. Selected ones could be done in the cloud (e.g., using AlchemyAPI and/or IBM Bluemix). Students are expected to bring their laptops to each class.

ITCS 5121. Information Visualization. (3) Cross-listed Course(s): DSBA 5121 and HCIP 5121. Prerequisite(s): CCI graduate standing or permission of instructor. Information visualization concepts, theories, design principles, popular techniques, evaluation methods, and information visualization applications.

ITCS 5122. Visual Analytics. (3) Prerequisite(s): Full CCI graduate standing and STAT 1220, STAT 1221, STAT 1222, STAT 2122, STAT 2223, or approval of the instructor. Introduces the new field of visual analytics, which integrates interactive analytical methods and visualization. Topics include: critical thinking, visual reasoning,

perception/cognition, statistical and other analysis techniques, principles of interaction, and applications.

ITCS 5123. Visualization and Visual Communication. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Understanding the relatively technical field of visualization from the point of view of visual communication, this course draws connections with photography, design, illustration, aesthetics, and art. Both technical and theoretical aspects of the various fields are covered, and the connections between them are investigated.

ITCS 5128. Programming Languages and Compilers. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to the concepts and techniques used in describing, defining, and implementing programming languages and their compilers. Introduction to parsing and parser construction; LL and LR grammars; syntax directed translation; data object representations; run time structures; intermediate languages; code optimization.

ITCS 5133. Numerical Computation Methods and Analysis. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to principles and techniques behind numerical methods and algorithms that underlie modern scientific and engineering applications. Roots of equations; linear systems (direct methods, LU/QR factorization, iterative methods); Eigen values and vectors; Interpolation, Approximation; Numerical Differentiation/Integration, ODEs and PDEs.

ITCS 5141. Computer Organization and Architecture. (3) Prerequisite(s): CCI graduate standing and undergraduate computer architecture course, or permission of instructor. Fundamentals of computer design; instruction set design, basic processor implementation techniques; pipelining; memory hierarchy; input/output. Cost/performance and hardware/software trade-offs.

ITCS 5145. Parallel Computing. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Types of parallel computers, programming techniques for multiprocessor and multicomputer systems, parallel strategies, algorithms, and languages.

ITCS 5146. Grid Computing. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Grid computing software components, standards, web services, security mechanisms, schedulers and resource brokers, workflow editors, grid portals, grid computing applications.

ITCS 5152. Computer Vision. (3) Prerequisite(s): CCI graduate standing and undergraduate course in linear algebra, or permission of instructor. General introduction to Computer Vision and its application. Topics include: low-level vision, 2D and 3D segmentation, 2D description, 2D recognition, 3D description and model-based recognition, and interpretation.

ITCS 5153. Applied Artificial Intelligence. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to fundamental concepts of Artificial Intelligence (AI), while focusing on the practical application of AI algorithms and technologies to the solution of real-world problems. Students work with state-of-the-art libraries and frameworks, such as OpenAI, TensorFlow, PyTorch, Azure AI, and OpenCV. Topics include: pathfinding, adversarial search, deep reinforcement learning, using neural networks to solve classification problems, speech recognition, language translation, object identification, and image manipulation.

ITCS 5156. Applied Machine Learning. (3) Explores the components of machine learning prediction functions for classification and regression with an emphasis on practical applications. Topics include: fundamental concepts, such as training, validation, overfitting, and error rates. Also introduces commonly-used machine learning algorithms, such as decision trees, naive Bayes, neural networks and random forests. Covers the complete machine learning pipeline, including data collection, feature creation, algorithms, and evaluation.

ITCS 5157. Computer-Aided Instruction. (3) Prerequisite(s): CCI graduate standing or permission of instructor. History of CAI; study of current CAI systems; development of man-machine dialogue; programming tools for CAI; information structures for computer-oriented learning. Advantages/disadvantages/ costs of CAI.

ITCS 5161. Intellectual Property Aspects of Computing. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Explores the broad field of intellectual property and the many aspects related to computing. Topics include: software copyrights, software patents, trademarks and service marks, employment contracts, non-compete agreements, software licenses, software development contracts, preservation of digital evidence, protection of trade secrets, cyberspace law and the use of mediation in IP disputes.

ITCS 5180. Mobile Application Development. (3) Cross-listed Course(s): ITIS 5180. Prerequisite(s): CCI graduate standing or permission of instructor. Mobile platforms are at the center of attention of users and organizations nowadays. Most organizations and businesses are rapidly migrating toward the cloud and need to provide a fast and easy mechanism for users to stay connected to their services. Mobile applications are the top trend nowadays given the high variety of new mobile devices and platforms such as Apple's iOS and Google's Android. In

this course, students are introduced to the foundations of mobile development and its unique requirements and constraints. Students design and build a variety of mobile applications with a hands-on and project-based approach.

ITCS 5181. Microcomputer Interfacing. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Signal conditioning, A/D conversion, noise, transmission line effects, signal processing, D/A conversion and serial/parallel interfaces.

ITCS 5182. Introduction to High Performance Computing. (3) Cross-listed Course(s): ITCS 4182. Fundamentals of parallel computer systems; throughput computing; memory hierarchies; computation/communication overlapping; mapping high level programs to low level components; leveraging accelerators; performance optimization; performance evaluation.

ITCS 5230. Introduction to Game Design and Development. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Basic concepts and techniques for electronic game design and development. Topics include: game history and genres, game design teams and processes, what makes a game fun, level and model design, game scripting and programming including computer graphics and animation, artificial intelligence, industry issues, and gender and games.

ITCS 5231. Advanced Game Design and Development. (3) Prerequisite(s): ITCS 5230. Advanced concepts and techniques for electronic game design and development. A project-centered course where students explore complex gameplay and interactivity. Explores topics from the introductory course in more depth, such as: applying software engineering techniques to developing games, advanced game programming and scripting, networking, graphics, physics, audio, game data structures and algorithms, and artificial intelligence.

ITCS 5232. Game Design and Development Studio. (3) Prerequisite(s): ITCS 5231 and permission of instructor. Application of advanced concepts and techniques for electronic game design and development. Teams use engineering techniques to incorporate game programming and scripting, networking, graphics, physics, audio, game data structures and algorithms, and artificial intelligence into an electronic game. Individuals develop a complete portfolio of prior work and the course project.

ITCS 5235. Game Engine Construction. (3) Prerequisite(s): ITCS 4120, ITCS 6120, or permission of instructor. Introduction to principles and techniques behind modern computer and console game engines. Graphics Rendering Pipeline (transformations, lighting ,shading); 2D/3D Texture Mapping; Image Based Rendering; Spatial Data Structures and Acceleration Algorithms; Level of Detail; Collision Detection, Culling and Intersection Methods; Vertex/Pixel Shaders; Pipeline Optimization; Rendering Hardware.

ITCS 5236. Artificial Intelligence for Computer Games. (3) Prerequisite(s): ITCS 6150 or permission of instructor. Application of advanced concepts and techniques in artificial intelligence for electronic game design and development. An investigation of the artificial intelligence techniques necessary for an agent to act, or appear to act, intelligently in interactive virtual worlds. Topics include: uncertainty reasoning, machine learning, perception, knowledge representation, search, and planning. Emphasis will be on implementation and experimentation with the goal of building robust intelligent agents in interactive entertainment domains. Elements of multi-agent collaboration and the use of cognitive architectures in interactive computer games will also be discussed.

ITCS 5237. Audio Processing for Entertainment Computing. (3) Prerequisite(s): ITCS 6114 or permission of instructor. Introduction to the principles and applications of audio (digital signal) processing focusing on entertainment domains. Topics include: analysis of signals, transforms, digital filter design techniques, audio engine development, file encoding/decoding, spatial sound rendering, optimization, and advanced audio techniques.

ITCS 6010. Topics in Computer Science. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Topics in computer science selected to supplement the regular course offerings. Students may register for multiple sections of the course with different topics in the same semester or in different semesters. *May be repeated for credit with change of topic.*

ITCS 6040. Topics in Data Science. (3) Topics in data science selected to supplement the regular course offerings. Students may register for multiple sections of the course with different topics in the same semester or in different semesters. *May be repeated with change of topic.*

ITCS 6050. Topics in Intelligent Systems. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Topics in intelligent systems selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

ITCS 6080. Topics in Computer Engineering. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Topics in computer engineering selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

ITCS 6100. Big Data Analytics for Competitive Advantage. (3) Cross-listed Course(s): DSBA 6100 and HCIP 6103. Prerequisite(s): CCI graduate standing or permission of

instructor. An introduction to the use of big data as a strategic resource. A focus is placed on integrating the knowledge of analytics tools with an understanding of how companies leverage data analytics to gain strategic advantage. A case approach is used to emphasize hands-on learning and a real-world view of big data analytics.

ITCS 6107. Formal Languages and Automata. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Detailed study of abstract models for the syntax of programming languages and information processing devices. Languages and their representation; grammars; finite automata and regular sets; context-free grammars and pushdown automata; Chomsky Hierarchy; closure properties of families of languages; syntax analysis.

ITCS 6110. Topics in Programming Languages and Compilers. (3) Prerequisite(s): ITCS 5128. A continuation of material in ITCS 5128 with emphasis on advanced aspects of optimization, data flow analysis, and error discovery.

ITCS 6111. Evolutionary Computation. (3) Prerequisite(s): ITCS 6114 or permission of instructor. General introduction to optimization problems. Optimization techniques: hill climbing, simulated annealing, evolution strategies, and genetic algorithms. Evolution programming techniques.

ITCS 6112. Software System Design and Implementation. (3) Cross-listed Course(s): HCIP 6112 and ITIS 6112. Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to the techniques involved in the planning and implementation of large software systems. Emphasis on human interface aspects of systems. Planning software projects; software design process; top-down design; modular and structured design; management of software projects; testing of software; software documentation; choosing a language for a software system.

ITCS 6114. Algorithms and Data Structures. (3) Cross-listed Course(s): ITCS 8114. Prerequisite(s): CCI graduate standing or permission of instructor. Analyzing algorithms and problems; data abstraction and data structures; recursion and induction; time and space complexities; searching and sorting; search trees and tries; hashing; heaps; dynamic programming; graph algorithms; string matching; NP-complete problems.

ITCS 6115. Advanced Algorithms. (3) Cross-listed Course(s): ITCS 8115. Randomized Algorithms; Parallel/Distributed algorithms; Approximation Algorithms; Combinatorial Optimization and Graph Algorithms; Algorithms in Non-Classical Models.

ITCS 6120. Computer Graphics. (3) Cross-listed Course(s): ITCS 8120. Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to the design and implementation of interactive graphics systems. Raster and vector display systems, I/O devices; graphics primitives and their attributes; raster algorithms and clipping; 2D/3D geometric transformations; 3D viewing and projections; hierarchical and procedural models; surface representation; color and lighting models; rendering algorithms; global illumination and texture mapping.

ITCS 6124. Illustrative Visualization. (3) Cross-listed Course(s): ITCS 8124. Prerequisite(s): CCI graduate standing or permission of the instructor. The state-of-the-art of illustrative visualization techniques, which transform large-scale, complex datasets to succinct, non-photorealistic visualization styles and at the same time preserve important data features. Topics include: 2D/3D stippling, interactive line drawings, animated visualization, non-photorealisitc rendering, design, and evaluation of illustrative visualization approaches.

ITCS 6125. Virtual and Augmented Reality. (3) Cross-listed Course(s): ITCS 8125. Prerequisite(s): CCI graduate standing or permission of instructor; previous programming experience in 3D computer graphics is recommended. The design and implementation of Virtual and Augmented Reality systems and applications. Topics include: position tracking, design of head-tracked and head-mounted displays, stereoscopic display, 3D user interface design, presence measurement, and applications.

ITCS 6126. Large Scale Information Visualization. (3) Cross-listed Course(s): ITCS 8126. Prerequisite(s): ITCS 4121 or ITCS 5121. Concept, theory, design principles, data processing techniques, and visual metaphors and interaction techniques for massive, multi-dimensional, multi-source, time-varying information exploration.

ITCS 6127. Real-Time Rendering Engines. (3). Cross-listed Course(s): ITCS 8127. Prerequisite(s): ITCS 6120 or permission of instructor. Advanced concepts and techniques employed in building real-time rendering systems that support a high level of realism as well as handle large geometric models. Topics include: modern graphics hardware, programmable shaders, shadow and environment mapping, image-based modeling and rendering, large data models (simplification, level of detail), high quality interactive rendering.

ITCS 6130. Advanced Computer Graphics. (3) Cross-listed Course(s): ITCS 8130. Prerequisite(s): ITCS 6120 or permission of instructor. Implicit and parametric representation; cubic surfaces; advanced reflection models; global illumination models - ray tracing, radiosity; shadow algorithms, texture mapping; volumetric modeling and rendering techniques; animation; advanced modeling techniques; particle systems, fractals.

ITCS 6132. Modeling and Analysis of Communication Networks. (3) Prerequisite(s): A course in communication networks or permission of instructor. The objective is to develop an understanding of modeling and analysis techniques for communication systems and networks. Enable the student to understand how to comparatively analyze the cost and performance impact of network architecture and protocol design decisions. Modeling techniques for analytical analysis, simulation based analysis, and measurement based analysis will be presented. Topics include: validation/verification of models, workload characterization, metric selection, presentation and interpretation of results. A semester long analysis project will be undertaken.

ITCS 6134. Digital Image Processing. (3) Cross-listed Course(s): ECGR 6118 and ECGR 8118. Prerequisite(s): CCI graduate standing or permission of instructor. Image perception; image types/applications; image restoration and enhancement; edge/boundary detection; image transformation; image segmentation; statistical and syntactical pattern recognition; image information measures and compression.

ITCS 6140. Data Visualization. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Emphasis on the methodology and application of data visualization to scientific and engineering data; data types and models; visualization methods; volume visualization; scalar, vector and tensor fields; multi-variate visualization; visualization systems and models; visualization applications; visualization software and hardware; research issues; and future trends.

ITCS 6144. Operating Systems Design. (3) Prerequisite(s): ITCS 6114 or permission of instructor. Introduction to features of a large-scale operating system with emphasis on resource-sharing environments. Computer system organization; resource management; multiprogramming; multi-processing; file systems; virtual machine concepts; protection and efficiency.

ITCS 6148. Advanced Object-Oriented Systems. (3) Cross-listed Course(s): ITIS 6148. Prerequisite(s): ITCS 6112, ITIS 6112, or permission of instructor. Issues related to the design, implementation, integration, and management of large object-oriented systems. Topics include: object models, object modeling, frameworks, persistent and distributed objects, and object-oriented databases.

ITCS 6150. Intelligent Systems. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Introduces core ideas in Artificial Intelligence (AI). Heuristic versus algorithmic methods; problem solving; game playing and decision making; automatic theorem proving; pattern recognition; adaptive learning; projects to illustrate theoretical concepts.

ITCS 6151. Intelligent Robotics. (3) Prerequisite(s): CCI graduate standing and undergraduate course in linear algebra, or permission of instructor. General introduction to spatial descriptions and transformations, and manipulator position and motion. More study on robot planning, programming, sensing, vision, and CAD/CAM.

ITCS 6152. Robot Motion Planning. (3) Prerequisite(s): ITCS 6114 or permission of instructor. Introduction to algorithmic techniques for robot motion planning. Topics include: configuration space representations, roadmap methods, cell decomposition methods, potential field techniques, randomized path planning, collision detection, nonholonomic motion planning, multiple robot coordination, and manipulation planning. These techniques are motivated by applications of motion planning to mobile robots and robot manipulators, assembly planning, computer aided design, computer graphics, and bioinformatics.

ITCS 6153. Neural Networks. (3) Prerequisite(s): ITCS 6114. Topics include: basic notions and models of artificial neural nets; single layer neural classifiers; multilayer one-way neural nets; single layer feedback networks; neural models of associative memory; self-organizing neural nets; translation between neural networks and knowledge bases; applications of neural networks.

ITCS 6154. Heuristic Search. (3) Prerequisite(s): ITCS 6150. Heuristics and problem representation; heuristic-search procedures; formal properties and performance analysis of heuristic methods; game-searching strategies and heuristic programming; search with probabilities; knowledge-guided search.

ITCS 6155. Knowledge-Based Systems. (3) Cross-listed Course(s): DSBA 6155. Prerequisite(s): ITCS 6162 or permission of instructor. Knowledge systems; knowledge discovery; association rules; action rules, hierarchical classifiers, cascade classifiers, query languages and their semantics; cooperative and collaborative systems; ontology and metadata; flexible query answering; chase algorithms and data sanitization methods; decision support systems in medicine; and automatic indexing of music.

ITCS 6156. Machine Learning. (3) Machine learning has been successfully applied to many different areas such as autonomous control of cars and robots, natural language processing, image recognition, health science, biology, and data mining. This course introduces fundamental concepts and methods to learn from data for computational data analysis, including pattern recognition, prediction, and visualization. For this, supervised learning, unsupervised learning, and reinforcement learning, as well as techniques including clustering, classification, support vector machines, and neural networks are covered.

ITCS 6157. Visual Databases. (3) Prerequisite(s): ITCS 6160, ITIS 6120, or permission of instructor. Topics include: representation of visual content, querying visual databases, content-based interactive browsing and navigation, system architecture, similarity models, indexing visual databases, data models and knowledge structures, image retrieval by similarity, and video retrieval by content.

ITCS 6158. Natural Language Processing. (3) Prerequisite(s): ITCS 6150. Principles, methodologies, and programming methods of natural language processing including foundations of natural language understanding, namely: lexical, syntactic, and semantic analysis, discourse integration, and pragmatic and morphological analysis.

ITCS 6159. Intelligent Tutoring Systems. (3) Prerequisite(s): CCI graduate standing or permission of the instructor. Introduces the issues relevant to creating adaptive learning systems using artificial intelligence and includes a project to build a small Intelligent Tutoring System (ITS). Topics include: representation of knowledge and cognition, ITS design, adaptive user interfaces, design and evaluation of feedback, experimental methods, educational data mining, history of intelligent tutoring, tutor authoring, and issues for implementation.

ITCS 6160. Database Systems. (3) Prerequisite(s): CCI graduate standing or permission of instructor. The modeling, programming, and implementation of database systems. Focuses on relational database systems, but may also address non-relational databases or other advanced topics. Topics include: (1) modeling: conceptual data modeling, ER diagram, relational data model, schema design and refinement; (2) programming: relational algebra and calculus, SQL, constraints, triggers, views; (3) implementation: data storage, indexing, query execution, query optimization, and transaction management; and (4) advanced: semi-structured data model, XML, and other emerging topics.

ITCS 6161. Advanced Topics in Database Systems. (3) Prerequisite(s): ITCS 6160, ITIS 6120, or permission of instructor. Continuation of ITCS 6160. Topics include: deductive databases; semantic query processing; intelligent and cooperative query languages; distributed databases; active databases; heterogeneous databases, multimedia databases; data and knowledge interchange; multidatabase systems; very large databases.

ITCS 6162. Knowledge Discovery in Databases. (3) Cross-listed Course(s): DSBA 6162, HCIP 6162, and ITIS 6162. Prerequisite(s): ITCS 6160 or ITIS 6120. Exploration of the entire knowledge discovery process. Topics include: setting up a problem, data preprocessing and warehousing, data mining in search for knowledge, knowledge evaluation, visualization and application in decision making. A broad range of systems, such as OLAP, LERS, DatalogicR+, C4.5, AQ15, Forty-Niner, CN2, QRAS, and discretization algorithms are also covered.

ITCS 6163. Data Warehousing. (3) Cross-listed Course(s): HCIP 6163 and ITIS 6163. Prerequisite(s): ITCS 6160 or ITIS 6120. Topics include: use of data in discovery of knowledge and decision making; the limitations of relational databases and SQL queries; the warehouse data models: multidimensional, star, snowflake; architecture of a data warehouse and the process of warehouse construction; data consolidation from various sources; optimization; techniques for data transformation and knowledge extraction; relations with enterprise modeling.

ITCS 6164. Design and Implementation of Online Management Information Systems. (3) Prerequisite(s): ITCS 6114 or permission of instructor. The fundamental concepts and philosophy of planning and implementing an online computer system. Characteristics of online systems; hardware requirements; modeling of online systems; performance measurement; language choice for online systems; organization techniques, security requirements; resource allocation.

ITCS 6165. Coding and Information Theory. (3) Prerequisite(s): knowledge of probability theory or permission of instructor. Information theory; coding theory; Shannon's theorem; Markov process; channel capacity; data transmission codes; error correcting codes; data compression; data encryption.

ITCS 6166. Computer Communications and Networks. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Introduction to the concepts of communication networks; types of networks; wired and wireless media; communication architectures; network protocols; coding and modulation; multiplexing and multiple access; error and flow control; routing; Internet protocols; transport protocols; assignments include implementation and analysis of network protocols

ITCS 6167. Advanced Networking Protocols. (3) Prerequisite(s): ITCS 6166 or ITCS 6168. Advanced networking concepts and protocols related to the design, implementation, integration, and management of networking and communication systems. Topics include: topology control protocols, ad hoc routing protocols, power management protocols, distributed data processing protocols for various networking systems (Internet, wireless mesh networks, ad hoc networks, sensor networks, peer-to-peer networks).

ITCS 6168. Wireless Communication Networks. (3) Prerequisite(s): CCI graduate standing in CS, SIS, ECE, or Optics and a prior course in networking, or permission of instructor. An overview of mobile systems and wireless networking technologies. Emphasis on resource

management, routing and quality of service at the MAC and networking layers for mobile systems. Students undertake a semester long research project to survey the research literature and identify specific challenges for cellular telecommunications, wireless LANS, ad hoc networks, mesh networks or sensor networks.

ITCS 6170. Logic for Artificial Intelligence. (3)
Prerequisite(s): ITCS 6150 or permission of instructor. Introduction to basic concepts of logic for artificial intelligence, including declarative knowledge, inference, resolution, non-monotonic reasoning, induction, reasoning with uncertain beliefs, distributed information systems, intelligent information systems, planning and intelligent-agent architecture.

ITCS 6171. Logic Programming. (3) Prerequisite(s): ITCS 6150 or permission of instructor. Prolog programming language; programming techniques in Prolog; foundations of logic programming including computability of Horn clause logic, completeness of resolution principle, complexity of unification algorithms, and verification of logic programs; principles of implementing logic programming systems; selected topics from applications of logic programming to expert systems, intelligent database systems, and/or natural language processing.

ITCS 6175. Computability and Complexity. (3)
Prerequisite(s): ITCS 6114. Study of computability, unsolvability, computational complexity. Concept of effective computability; recursive functions; mathematical models of computation; universal Turing machines; unsolvable problems; time and space complexity of computations; NP-completeness problems; sub-recursive hierarchies.

ITCS 6181. Switching and Automata Theory. (3)
Prerequisite(s): permission of instructor. Topics include: sets, relations, lattices, Boolean algebras; functional decomposition and symmetric functions; threshold logic; multiple-valued logic; fault detection and fault tolerant design; finite state machines, incompletely specified machines, minimization; state identification and fault detection experiments; finite state recognizers.

ITCS 6182. Computer System Architecture. (3)
Prerequisite(s): CCI graduate standing or permission of instructor. Survey of existing and proposed architectures; pipelined, dataflow, multi-bus and parallel system architecture, and interconnection network architectures. This course is project-based and requires written and verbal presentation of projects.

ITCS 6183. Computer Arithmetic. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Principles, architecture, and design of fast two operand adders; multi-operand adders, standard multipliers, and dividers. Cellular array multipliers and dividers. Floating point processes, BCD, and excess three adders, multipliers, and dividers.

ITCS 6184. Fault Tolerant Digital Systems. (3)
Prerequisite(s): CCI graduate standing and undergraduate computer architecture course, or permission of instructor. Design and analysis of fault tolerant digital systems including design techniques, qualitative and quantitative methods of evaluation, and available fault tolerant digital systems.

ITCS 6186. Application Specifics System Design and Simulation. (3) Prerequisite(s): CCI graduate standing and undergraduate computer architecture course, or permission of instructor. Project-oriented course on techniques and methodology in design and development of special purpose systems valuable for business, healthcare, and industrial community; course content includes system specifications, interface structure and data communication, interconnection architecture, and techniques for testing and debugging.

ITCS 6190. Cloud Computing for Data Analysis. (3) Cross-listed Course(s): DSBA 6190 and ITCS 8190. Prerequisite(s): ITCS 6114 or permission of instructor; familiarity with Java, Unix, Data Structures and Algorithms, Linear Algebra, and Probability and Statistics; good programming skills and a solid mathematical background. Introduction to the basic principles of cloud computing for data-intensive applications. Focuses on parallel computing using Google's MapReduce paradigm on Linux clusters, and algorithms for large-scale data analysis applications in web search, information retrieval, computational advertising, and business and scientific data analysis. Students read and present research papers on these topics, and implement programming projects using Hadoop, an open source implementation of Google's MapReduce technology, and related NoSQL technologies for analyzing unstructured data.

ITCS 6211. Studio Lab I. (4) Cross-listed Course(s): ARCH 7211 and ITIS 6211. The Studio/Lab sequence situates students with varying backgrounds in an educational environment that allows them to develop and test innovative computational design tools, applications and settings. Each semester is jointly taught by faculty from the School of Architecture and the College of Computing and Informatics, and is organized around a topic chosen by the participating faculty. Each focused topic requires expertise both in spatial design and computational design, and results in prototypes and evaluation.

ITCS 6212. Studio Lab II. (4) Cross-listed Course(s): ARCH 7212 and ITIS 6212. The Studio/Lab sequence situates students with varying backgrounds in an educational environment that allows them to develop and test innovative computational design tools, applications and

settings. Each semester is jointly taught by faculty from School of Architecture and the College of Computing and Informatics, and is organized around a topic chosen by the participating faculty. Each focused topic requires expertise both in spatial design and computational design, and results in prototypes and evaluation.

ITCS 6216. Introduction to Cognitive Science. (3) Cross-listed Course(s): PSYC 6216 and ITIS 6216. Multiple perspectives on the study of intelligent systems. Broad coverage of such topics as philosophy of mind; human memory processes; reasoning and problem solving; artificial intelligence; language processing (human and machine); neural structures and processes; and vision. Also included is participation in the cognitive science seminar.

ITCS 6220. Pattern Recognition. (3) Prerequisite(s): CCI graduate standing or permission of instructor. Topics include: pattern pre-processing and feature extraction (entropy minimization, orthogonal expansion, Fourier expansion, Karhunen-Loeve expansion, PCA); linear decision functions; orthogonal and non-orthogonal systems of functions; pattern classification by distance functions (Nearest Neighbor, K-means, ISODATA); pattern classification by likelihood functions (Bayesian classifiers, estimation of probability density function); trainable classifiers (LMSE, Perceptron, multi-layer perceptrons, fuzzy classifiers); stochastic processes; classification on categorical attributes.

ITCS 6222. Biomedical Signal Processing. (3) Prerequisite(s): CCI graduate standing. Topics include: fundamental techniques in processing, analysis, feature extraction, and classification of complex signals; origin and processing techniques for biomedical signals, including ECG, ENG, EEG, MEG, ERG, EMG, respiratory signals, blood sound, and pressure signals.

ITCS 6224. Biomedical Image Processing. (3) Prerequisite(s): CCI graduate standing and undergraduate course in linear algebra, or permission of instructor. Topics include: review of image processing and pattern recognition (2-D Fourier transforms, 2-D Wavelet transform, denoising of medical images); origin and processing of X-ray images; CT images; MRI images; ultrasonic images; PET images; thermal images; electrical impedance images; cross-registration between images of different source; stereotactic neurosurgery; stereotactic radiosurgery/radiotherapy; robot-assisted surgery.

ITCS 6226. Bioinformatics. (3) Prerequisite(s): CCI graduate standing. Topics include: brief review of molecular biology, proteins, and their classifications, DNA, RNA, and using microarrays and gene chips for sequencing; review of computational techniques for bioinformatics, expectation maximization, Bayesian classifiers, dynamic programming, information theory and entropy analysis, Markov chain models, and neural networks; computational techniques for local and multiple sequence alignment; application of Markov chains in finding genes; using information theory to estimate binding sites, start Codon prediction; RNA secondary structure prediction; computational techniques for protein function prediction; advanced signal processing techniques in feature extraction from protein sequences.

ITCS 6228. Medical Informatics. (3) Cross-listed Course(s): HCIP 6228. Prerequisite(s): CCI graduate standing or permission of instructor. Focuses on methods and techniques used in storage, communication, processing, analysis, integration, management, and distribution of medical information. Emphasizes the applications of telemedicine and intelligent computer-aided decision making systems in different medical and surgical systems. Discusses the computational methods to accept or reject a new drug or a new treatment for a given disease.

ITCS 6265. Advanced Topics in Knowledge Discovery in Databases. (3) Prerequisite(s): ITCS 6162 or permission of instructor. Continuation and extension of ITCS 6162. Information visualization in data mining and knowledge discovery, predictive data mining, mining of multimedia sources, mining of unstructured data, distributed data mining, mining of Web data/information, mining complex types of data, mining of biotechnology data, applications, and trends in data mining.

ITCS 6267. Intelligent Information Retrieval. (3) Prerequisite(s): ITCS 6114 or permission of instructor. Topics include: definition of the information retrieval problem, modeling the information retrieval problem, evaluation of information retrieval, query languages and operations, text processing, indexing and searching, parallel and distributed information retrieval, user interface and visualization, multimedia information retrieval, and information retrieval applications.

ITCS 6345. Modern Data Science Systems. (3) Cross-listed Course(s): DSBA 6345. Prerequisite(s): DSBA 6100 or ITCS 6100. Advanced and recent techniques in data science, and their applications to business problems. Topics include: enterprise search and question answering, machine learning with neural networks, probabilistic and graph algorithms, and topological data analysis. Most assignments are done "in the cloud." The course assumes basic knowledge of data science exemplified by a graduate, undergraduate, or online machine learning course; a natural language processing course; as well as knowledge of elementary linear algebra, calculus, and statistics. Some experience with cloud computing is also expected.

ITCS 6490. Industrial Internship. (0 to 6) Cross-listed Course(s): HCIP 6490. Prerequisite(s): Completion of six hours of graduate coursework. Full- or part-time

academic year internship in computer science areas complementary to the concentration area of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's internship program must be approved by the supervising faculty, the academic advisor, and the graduate program director. A mid-term report and a final report to be evaluated by the supervising faculty are required. *Grading is on a Pass/Unsatisfactory basis* by the supervising faculty in consultation with off-campus supervisor at the internship organization. The credit hours may not be part of the minimum 30 credit hours for graduation. *May be repeated for credit.*

ITCS 6500. Complex Adaptive Systems. (3) Cross-listed Course(s): DSBA 6500, HCIP 6500, ITCS 8500, ITIS 6500, and ITIS 8500. Prerequisite(s): CCI graduate standing or permission of instructor. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Examples of current research efforts are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity.

ITCS 6617. Computational Human Behavior Modeling. (3) Cross-listed Course(s): PSYC 6617. Computational human behavior modeling is a research area at the intersection of computer science and social science, including psychology, sociology, communication, and linguistics. Its objective is to advance both fields by combining the power of data analytics and artificial intelligence with the scientific method for studying human data and human behavior. This course is a research seminar in which students engage with research through a series of readings, understanding concepts in the social sciences about human language, attitudes, and behaviors and understand how these concepts can be formalized into computational models or algorithms.

ITCS 6690. Computer Science Seminar. (3) Prerequisite(s): at least 9 graduate ITCS/ITIS hours and permission of department. Experience for the advanced M.S. student on current problems of computer design and application. (May be used by a student or small group of students to work with a professor on a topic of mutual interest. May be used to give a course on a topic announced in advance.)

ITCS 6880. Individual Study. (1 to 3) Prerequisite(s): At least 9 graduate ITCS/ITIS hours and permission of department. With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects. *May be repeated for credit.*

ITCS 6881. Individual Study in AI, Robotics, and Gaming. (1 to 3) Prerequisite(s): At least 9 graduate ITCS/ITIS credit hours and permission of department. With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects in AI, Robotics, and Gaming. *May be repeated for credit.*

ITCS 6882. Individual Study in Data Science. (1 to 3) Prerequisite(s): At least 9 graduate ITCS/ITIS credit hours and permission of department. With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects in Data Science. *May be repeated for credit.*

ITCS 6883. Individual Study in Software, Systems, and Networks. (1 to 3) With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects in Software, Systems, and Networks. *May be repeated for credit.*

ITCS 6991. Computer Science Thesis. (1 to 3) Prerequisite(s): Permission of department. Graduate thesis research. Detailed exploration of an area of computer science chosen for thesis research. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit but no more than six credit hours may be applied to M.S. degree requirements.*

ITCS 8010. Topics in Computer Science. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Topics in computer science selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters.

ITCS 8050. Topics in Intelligent Systems. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Topics in intelligent systems selected to supplement the regular

course offerings. *May be repeated for credit with change of topic.*

ITCS 8080. Topics in Computer Engineering. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Topics in computer engineering selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

ITCS 8107. Formal Languages and Automata. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Detailed study of abstract models for the syntax of programming languages and information processing devices. Languages and their representation; grammars; finite automata and regular sets; context-free grammars and pushdown automata; Chomsky Hierarchy; closure properties of families of languages; syntax analysis.

ITCS 8110. Topics in Programming Languages and Compilers. (3) Prerequisite(s): ITCS 5128. A continuation of material in ITCS 5128 with emphasis on advanced aspects of optimization, data flow analysis, and error discovery.

ITCS 8111. Evolutionary Computation. (3) Prerequisite(s): ITCS 8114 or permission of instructor. General introduction to optimization problems. Optimization techniques: hill climbing, simulated annealing, evolution strategies, genetic algorithms. Evolution programming techniques.

ITCS 8112. Software Systems Design and Implementation. (3) Cross-listed Course(s): ITIS 8112. Prerequisite(s): Ph.D. student standing or permission of instructor. Introduction to the techniques involved in the planning and implementation of large software systems. Emphasis on human interface aspects of systems. Planning software projects; software design process; top-down design; modular and structured design; management of software projects; testing of software; software documentation; choosing a language for software system.

ITCS 8114. Algorithms and Data Structures. (3) Cross-listed Course(s): ITCS 6114. Prerequisite(s): Ph.D. student standing or permission of instructor. Analyzing algorithms and problems; data abstraction and data structures; recursion and induction; time and space complexities; searching and sorting; search trees and tries; hashing; heaps; dynamic programming; graph algorithms; string matching; NP-complete problems.

ITCS 8115. Advanced Algorithms. (3) Cross-listed Course(s): ITCS 6115. Topics include: Randomized Algorithms; Parallel/Distributed Algorithms; Approximation Algorithms; Combinatorial Optimization and Graph Algorithms; and Algorithms in Non-Classical Models.

ITCS 8120. Computer Graphics. (3) Cross-listed Course(s): ITCS 6120. Prerequisite(s): Ph.D. student standing or permission of instructor. Introduction to the design and implementation of interactive graphics systems. Raster and vector display systems, I/O devices; graphics primitives and their attributes; raster algorithms and clipping; 2D/3D geometric transformations; 3D viewing and projections; hierarchical and procedural models; surface representation; color and lighting models; rendering algorithms; global illumination and texture mapping.

ITCS 8124. Illustrative Visualization. (3) Cross-listed Course(s): ITCS 6124. Prerequisite(s): Graduate standing or permission of the instructor. The state-of-the-art of illustrative visualization techniques, which transform large-scale, complex datasets to succinct, non-photorealistic visualization styles and at the same time preserve important data features. Topics include: 2D/3D stippling, interactive line drawings, animated visualization, non-photorealisitc rendering, design, and evaluation of illustrative visualization approaches.

ITCS 8125. Virtual and Augmented Reality. (3) Cross-listed Course(s): ITCS 6125. Prerequisite(s): Ph.D. student standing or permission of instructor; previous programming experience in 3D computer graphics is recommended. The design and implementation of Virtual and Augmented Reality systems and applications. Topics include: position tracking, design of head-tracked and head-mounted displays, stereoscopic display, 3D user interface design, presence measurement, and applications.

ITCS 8126. Large Scale Information Visualization.(3) Cross-listed Course(s): ITCS 6126. Prerequisite(s): ITCS 4121 or ITCS 5121. Concept, theory, design principles, data processing techniques, and visual metaphors and interaction techniques for massive, multi-dimensional, multi-source, time-varying information exploration.

ITCS 8127. Real-Time Rendering Engines. (3) Cross-listed Course(s): ITCS 6127. Prerequisite(s): ITCS 6120 or permission of instructor. Focuses on advanced concepts and techniques employed in building real-time rendering systems that support a high level of realism as well as handle large geometric models. Topics include: modern graphics hardware, programmable shaders, shadow and environment mapping, image-based modeling and rendering, large data models (simplification, level of detail), high quality interactive rendering.

ITCS 8130. Advanced Computer Graphics. (3) Cross-listed Course(s): ITCS 6130. Prerequisite(s): ITCS 8120 or permission of instructor. Implicit and parametric representation; cubic surfaces; advanced reflection models; global illumination models - ray tracing, radiosity; shadow algorithms, texture mapping; volumetric modeling and rendering techniques; animation; advanced modeling techniques; particle systems, fractals.

ITCS 8132. Modeling and Analysis of Communication Networks. (3) Prerequisite(s): A course in communication networks or permission of instructor. Students develop an understanding of modeling and analysis techniques for communication systems and networks. Comparatively analyze the cost and performance impact of network architecture and protocol design decisions. Modeling techniques for analytical analysis, simulation based analysis, and measurement based analysis. Topics include: validation/verification of models, workload characterization, metric selection, presentation and interpretation of results. A semester long analysis project is undertaken.

ITCS 8134. Digital Image Processing. (3) Cross-listed Course(s): ECGR 6118. Prerequisite(s): Ph.D. student standing or permission of instructor. Image perception; image types/applications; image restoration and enhancement; edge/boundary detection; image transformation; image segmentation; statistical and syntactical pattern recognition; image information measures and compression.

ITCS 8140. Data Visualization. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Emphasis on the methodology and application of data visualization to scientific and engineering data; data types and models; visualization methods; volume visualization; scalar, vector and tensor fields; multi-variate visualization; visualization systems and model; visualization applications; visualization software and hardware; research issues and future trends.

ITCS 8144. Operating Systems Design. (3) Prerequisite(s): ITCS 8114 or permission of instructor. Introduction to features of a large-scale operating system with emphasis on resource-sharing environments. Computer system organization; resource management; multiprogramming; multi-processing; file systems; virtual machine concepts; protection and efficiency.

ITCS 8148. Advanced Object-Oriented Systems. (3) Prerequisite(s): ITCS 8112 or permission of instructor. Focuses on issues related to the design, implementation, integration, and management of large object-oriented systems. Topics include: object models, object modeling, frameworks, persistent and distributed objects, and object-oriented databases.

ITCS 8150. Intelligent Systems. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Introduction to core ideas in AI. Heuristic versus algorithmic methods; problem solving; game playing and decision making; automatic theorem proving; pattern recognition; adaptive learning; projects to illustrate theoretical concepts.

ITCS 8151. Intelligent Robotics. (3) Prerequisite(s): Ph.D. student standing and an undergraduate course in linear algebra, or permission of instructor. General introduction to spatial descriptions and transformations, and manipulator position and motion. More study on robot planning, programming, sensing, vision, and CAD/CAM.

ITCS 8152. Robot Motion Planning. (3) Prerequisite(s): ITCS 8114 or permission of instructor. Introduction to algorithmic techniques for robot motion planning. Topics include: configuration space representations, roadmap methods, cell decomposition methods, potential field techniques, randomized path planning, collision detection, nonholonomic motion planning, multiple robot coordination, and manipulation planning. These techniques are motivated by applications of motion planning to mobile robots and robot manipulators, assembly planning, computer aided design, computer graphics, and bioinformatics.

ITCS 8153. Neural Networks. (3) Prerequisite(s): ITCS 8114. Topics include: Basic notions and models of artificial neural nets; single layer neural classifiers; multilayer one-way neural nets; single layer feedback networks; neural models of associative memory; self-organizing neural nets; translation between neural networks and knowledge bases; applications of neural networks.

ITCS 8154. Heuristic Search. (3) Prerequisite(s): ITCS 8150. Heuristics and problem representation; heuristic-search procedures; formal properties and performance analysis of heuristic methods; game-searching strategies and heuristic programming; search with probabilities; knowledge-guided search.

ITCS 8155. Knowledge-Based Systems. (3) Prerequisite(s): ITCS 8162 or permission of instructor. Knowledge systems; knowledge discovery; association rules; action rules, hierarchical classifiers, cascade classifiers, query languages and their semantics; cooperative and collaborative systems; ontology and metadata; flexible query answering; chase algorithms and data sanitization methods; decision support systems in medicine; and automatic indexing of music.

ITCS 8156. Machine Learning. (3) Prerequisite(s): ITCS 8150 or permission of instructor. Machine learning methods and techniques including: acquisition of declarative knowledge; organization of knowledge into new, more effective representations; development of new skills through instruction and practice; and discovery of new facts and theories through observation and experimentation.

ITCS 8157. Visual Databases. (3) Prerequisite(s): ITCS 8160 or permission of instructor. Topics include: Representation of visual content, querying visual databases, content-based interactive browsing and navigation, system architecture, similarity models, indexing visual databases, data models

and knowledge structures, image retrieval by similarity, and video retrieval by content.

ITCS 8158. Natural Language Processing. (3) Prerequisite(s): ITCS 8150. Principles, methodologies, and programming methods of natural language processing including foundations of natural language understanding, namely: lexical, syntactic, and semantic analysis, discourse integration, and pragmatic and morphological analysis.

ITCS 8159. Intelligent Tutoring Systems. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Introduces the issues relevant to creating adaptive learning systems using artificial intelligence and includes a project to build a small Intelligent Tutoring System (ITS). Topics include: representation of knowledge and cognition, ITS design, adaptive user interfaces, design and evaluation of feedback, experimental methods, educational data mining, history of intelligent tutoring, tutor authoring, and issues for implementation.

ITCS 8160. Database Systems. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. The modeling, programming, and implementation of database systems. Focuses on relational database systems, but may also address non-relational databases or other advanced topics. Topics include: (1) modeling: conceptual data modeling, ER diagram, relational data model, schema design and refinement; (2) programming: relational algebra and calculus, SQL, constraints, triggers, views; (3) implementation: data storage, indexing, query execution, query optimization, and transaction management; and (4) advanced: semi-structured data model, XML, and other emerging topics.

ITCS 8161. Advanced Topics in Database Systems. (3) Prerequisite(s): ITCS 8160 or permission of instructor. Continuation of ITCS 8160. Topics include: deductive databases; semantic query processing; intelligent and cooperative query languages; distributed databases; active databases; heterogeneous databases, multimedia databases; data and knowledge interchange; multidatabase systems; very large databases.

ITCS 8162. Knowledge Discovery in Databases. (3) Prerequisite(s): ITCS 8160 or permission of instructor. The entire knowledge discovery process is covered. Topics include: setting up a problem, data preprocessing and warehousing, data mining in search for knowledge, knowledge evaluation, visualization and application in decision making. A broad range of systems, such as OLAP, LERS, DatalogicR+, C4.5, AQ15, Forty-Niner, CN2, QRAS, and discretization algorithms are covered.

ITCS 8163. Data Warehousing. (3) Cross-listed Course(s): ITIS 8163. Prerequisite(s): ITCS 8160 or ITIS 8120. Topics include: use of data in discovery of knowledge and decision making; the limitations of relational databases and SQL queries; the warehouse data models: multidimensional, star, snowflake; architecture of data warehouse and the process of warehouse construction; data consolidation from various sources; optimization; techniques for data transformation and knowledge extraction; relations with enterprise modeling.

ITCS 8164. Design and Implementation of Online Management Information Systems. (3) Prerequisite(s): ITCS 8114 or permission of instructor. The fundamental concepts and philosophy of planning and implementing an online computer system. Characteristics of online systems; hardware requirements; modeling of online systems; performance measurement; language choice for online systems; organization techniques, security requirements; resource allocation.

ITCS 8165. Coding and Information Theory. (3) Prerequisite(s): knowledge of probability theory or permission of instructor. Information theory; coding theory; Shannon's theorem; Markov process; channel capacity; data transmission codes; error correcting codes; data compression; data encryption.

ITCS 8166. Computer Communications and Networks. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Introduction to the concepts of communication networks; types of networks; wired and wireless media; communication architectures; network protocols; coding and modulation; multiplexing and multiple access; error and flow control; routing; Internet Protocols; transport protocols. Assignments include implementation and analysis of network protocols.

ITCS 8167. Advanced Networking Protocols. (3) Prerequisite(s): ITCS 8166 or ITCS 8168. Focuses on advanced networking concepts and protocols related to the design, implementation, integration, and management of networking and communication systems. Topics include: topology control protocols, ad hoc routing protocols, power management protocols, distributed data processing protocols for various networking systems (Internet, wireless mesh networks, ad hoc networks, sensor networks, peer-to-peer networks).

ITCS 8168. Wireless Communication Networks. (3) Prerequisite(s): Ph.D. student standing in CS, SIS, ECE, or Optics and a prior course in networking, or permission of instructor. An overview of mobile systems and wireless networking technologies. Emphasis on resource management, routing and quality of service at the MAC and networking layers for mobile systems. Students undertake a semester long research project to survey the research literature and identify specific challenges for cellular telecommunications, wireless LANS, ad hoc networks, mesh networks or sensor networks.

ITCS 8170. Logic for Artificial Intelligence. (3)
Prerequisite(s): ITCS 8150 or permission of instructor. Introduction to basic concepts of logic for artificial intelligence, including declarative knowledge, inference, resolution, nonmonotonic reasoning, induction, reasoning with uncertain beliefs, distributed information systems, intelligent information systems, planning and intelligent-agent architecture.

ITCS 8171. Logic Programming. (3) Prerequisite(s): ITCS 8150 or permission of instructor. Prolog programming language; programming techniques in Prolog; foundations of logic programming including computability of Horn clause logic, completeness of resolution principle, complexity of unification algorithms, and verification of logic programs; principles of implementing logic programming systems; selected topics from applications of logic programming to expert systems, intelligent database systems, and/or natural language processing.

ITCS 8175. Computability and Complexity. (3)
Prerequisite(s): ITCS 8114. Study of computability, unsolvability, computational complexity. Concept of effective computability; recursive functions; mathematical models of computation; universal Turing machines; unsolvable problems; time and space complexity of computations; NP-completeness problems; subrecursive hierarchies.

ITCS 8181. Switching and Automata Theory. (3)
Prerequisite(s): permission of instructor. Topics include: sets, relations, lattices, Boolean algebras; functional decomposition and symmetric functions; threshold logic; multiple-valued logic; fault detection and fault tolerant design; finite state machines, incompletely specified machines, minimization; state identification and fault detection experiments; finite state recognizers.

ITCS 8182. Computer System Architecture. (3)
Prerequisite(s): Ph.D. student standing or permission of instructor. Survey of existing and proposed architectures; pipelined, dataflow, multi-bus and parallel system architecture, and interconnection network architectures. Project-based and requires written and verbal presentation of projects.

ITCS 8183. Computer Arithmetic. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Principles, architecture, and design of fast two operand adders; multioperand adders, standard multipliers, and dividers. Cellular array multipliers and dividers. Floating point processes, BCD, and excess three adders, multipliers, and dividers.

ITCS 8186. Application Specifics System Design and Simulation. (3) Prerequisite(s): Ph.D. student standing and undergraduate computer architecture course, or permission of instructor. Project-oriented course on techniques and methodology in design and development of special purpose systems valuable for business, healthcare, and industrial community; course content include system specifications, interface structure and data communication, interconnection architecture, and techniques for testing and debugging.

ITCS 8190. Cloud Computing for Data Analysis. (3) Cross-listed Course(s): DSBA 6190 and ITCS 6190. Prerequisite(s): ITCS 8114 or permission of instructor; familiarity with Java, Unix, Data Structures and Algorithms, Linear Algebra, and Probability and Statistics; good programming skills and a solid mathematical background. Introduction to the basic principles of cloud computing for data-intensive applications. Focuses on parallel computing using Google's MapReduce paradigm on Linux clusters, and algorithms for large-scale data analysis applications in web search, information retrieval, computational advertising, and business and scientific data analysis. Students read and present research papers on these topics, and implement programming projects using Hadoop, an open source implementation of Google's MapReduce technology, and related NoSQL technologies for analyzing unstructured data.

ITCS 8220. Pattern Recognition. (3) Prerequisite(s): Ph.D. student standing or permission of instructor. Topics include: Pattern pre-processing and feature extraction (entropy minimization, orthogonal expansion, Fourier expansion, Karhunen-Loeve expansion, PCA); linear decision functions; orthogonal and non-orthogonal systems of functions; pattern classification by distance functions (Nearest Neighbor, K-means, ISODATA); pattern classification by likelihood functions (Bayesian classifiers, estimation of probability density function); trainable classifiers (LMSE, Perceptron, multi-layer perceptrons, fuzzy classifiers); stochastic processes; classification on categorical attributes.

ITCS 8222. Biomedical Signal Processing. (3) Prerequisite(s): Ph.D. student standing. Topics include: Fundamental techniques in processing, analysis, feature extraction, and classification of complex signals; origin and processing techniques for biomedical signals, including ECG, ENG, EEG, MEG, ERG, EMG, respiratory signals, blood sound, and pressure signals.

ITCS 8224. Biomedical Image Processing. (3)
Prerequisite(s): Ph.D. student standing and undergraduate course in linear algebra, or permission of instructor. Topics include: Review of image processing and pattern recognition (2-D Fourier transforms, 2-D Wavelet transform, denoising of medical images); origin and processing of X-ray images; CT images; MRI images; ultrasonic images; PET images; thermal images; electrical

impedance images; cross-registration between images of different source; stereotactic neurosurgery; stereotactic radiosurgery/radiotherapy; robot-assisted surgery.

ITCS 8226. Bioinformatics. (3) Prerequisite(s): Ph.D. student standing. Topics include: Brief Review of molecular biology, proteins and their classifications, DNA, RNA, and using microarrays and gene chips for sequencing; review of computational techniques for bioinformatics, expectation maximization, Bayesian classifiers, dynamic programming, information theory and entropy analysis, Markov chain models, and neural networks; computational techniques for local and multiple sequence alignment; application of Markov chains in finding genes; using information theory to estimate binding sites, start Codon prediction; RNA secondary structure prediction; computational techniques for protein function prediction; Advanced signal processing techniques in feature extraction from protein sequences.

ITCS 8228. Medical Informatics. (3) Prerequisite(s): Ph.D. student standing. Focuses on methods and techniques used in storage, communication, processing, analysis, integration, management, and distribution of medical information. Emphasizes the applications of telemedicine and intelligent computer-aided decision making systems in different medical and surgical systems. Discusses the computational methods to accept or reject a new drug or a new treatment for a given disease.

ITCS 8265. Advanced Topics in Knowledge Discovery in Databases. (3) Prerequisite(s): ITCS 8162 or permission of instructor. Continuation and extension of ITCS 8162. Information visualization in data mining and knowledge discovery, predictive data mining, mining of multimedia sources, mining of unstructured data, distributed data mining, mining of Web data/information, mining complex types of data, mining of biotechnology data, applications and trends in data mining.

ITCS 8267. Intelligent Information Retrieval. (3) Prerequisite(s): ITCS 8114 or permission of instructor. Topics include: definition of the information retrieval problem, modeling the information retrieval problem, evaluation of information retrieval, query languages and operations, text processing, indexing and searching, parallel and distributed information retrieval, user interface and visualization, multimedia information retrieval, and information retrieval applications.

ITCS 8500. Complex Adaptive Systems. (3) Cross-listed Course(s): DSBA 6500, HCIP 6500, ITCS 6500, ITIS 6500, and ITIS 8500. Prerequisite(s): Permission of instructor. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Covers these and similar topics in an interactive manner. Examples of our current research effort are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity.

ITCS 8690. Computer Science Seminar. (3) Prerequisite(s): at least 9 graduate ITCS/ITIS hours and permission of department. Experience for the advanced Ph.D. student on current problems of computer design and application. (May be used by a student or small group of students to work with a professor on a topic of mutual interest. May be used to give a course on a topic announced in advance.)

Software and Information Systems (ITIS)

ITIS 5101. Foundations of Programming. (3) Prerequisite(s): Graduate standing and permission of department. Takes students from no experience in programming to having an understanding of how to produce software that is relevant to their domain knowledge. Students learn to think about problem solutions that are systematic and repeatable (algorithms), and translatable to code. Topics include: Algorithmic thinking; Programming with primitive data types; Introduction to Object-Oriented programming; Recovering gracefully from errors and exceptions; Unit testing; Recursion; ADTs (Stacks & Queues, Linked Nodes, Lists, Trees, Hash Functions); Introduction to Big O Analysis and ADTs; Sorting and Searching.

ITIS 5135. Web-Based Application Design and Development. (3) Prerequisite(s): Basic programming skills and permission of department. Students learn to design and develop interactive webpages with significant focus on programming. Topics include: components of a web application, web design, and development guidelines, coding with programming languages used for web applications, manipulation of the Document Object Model (DOM), event-driven programming, asynchronous exchange of data, and web accessibility. By the end of the course, students develop an interactive and accessible website with practical intent.

ITIS 5166. Network-Based Application Development. (3) Cross-listed Course(s): HCIP 5166. Prerequisite(s): CCI graduate standing or permission of department. Examines the issues related to network based application development. Topics include: introduction to computer networks, web technologies and standards, network based programming methodologies, languages, tools and standards

ITIS 5180. Mobile Application Development. (3) Cross-listed Course(s): ITCS 5180. Prerequisite(s): CCI graduate standing or permission of department. Mobile platforms are at the center of attention of users and organizations nowadays. Most organizations and businesses are rapidly migrating toward the cloud and need to provide a fast and easy mechanism for users to stay connected to their services. Mobile applications are the top trend nowadays given the high variety of new mobile devices and platforms such as Apple's iOS and Google's Android. In this course, students are introduced to the foundations of mobile development and its unique requirements and constraints. Students design and build a variety of mobile applications with a hands-on and project-based approach.

ITIS 5221. Secure Programming and Penetration Testing. (3) Prerequisite(s): ITIS 4166 or ITIS 5166, or permission of department. Techniques for web application penetration testing, secure software development techniques for network based applications. Automated approaches such as static code analysis and application scanning are also discussed.

ITIS 5246. Competitive Cyber Defense. (3) Cross-listed Course(s): ITIS 4246. Hands-on experience with designing, deploying, securing, and defending enterprise network services. Topics include: securing network communication, single-sign-on services, firewall and IDS deployment, security policy design and development, log analysis, securing critical network infrastructure, network access control policies, penetration testing tools, secure information flow, and secrets management. Students are expected to demonstrate their ability to defend these services against adversary attacks.

ITIS 5250. Computer Forensics. (3) Cross-listed Course(s): HCIP 5250. Prerequisite(s): CCI graduate standing or permission of department. The identification, extraction, documentation, interpretation, and preservation of computer media for evidentiary purposes and/or root cause analysis. Topics include: techniques for discovering digital evidence; responding to electronic incidents; tracking communications through networks; understanding electronic media, crypto-literacy, data hiding, hostile code, and Windows™ and UNIX™ system forensics; and the role of forensics in the digital environment.

ITIS 5260. Introduction to Security Analytics. (3) Cross-listed Course(s): ITIS 4260. Prerequisite(s): ITIS 6200. Focuses on security-related sense-making and decision-making based on data analytics techniques. Topics include: data cleaning and storage techniques, introduction to R, clustering analysis and statistical inference for security; log analysis; event correlation, anomaly detection, cyber threat intelligence, and use of public cybersecurity information resources.

ITIS 5280. Advanced Mobile Application Development. (3) Prerequisite(s): ITCS 5180 or ITIS 5180. Exploration of a wide range of mobile application development concepts, frameworks, and patterns. Introduction to real world mobile application projects in partnership with university and industrial partners, as well as Agile Development concepts and up-to-date Agile and team management tools. The course is project-based; students are paired with a subject matter expert and work on a single project throughout the semester, which is expected to result in a functioning mobile app prototype.

ITIS 5331. Web-Based Mobile and IoT Firmware Security. (3) An introduction to recent security topics in web-based mobile and Internet of Things (IoT) software security. Explores vulnerability types, development of vulnerable app testbeds, exploit creation, and software defenses.

ITIS 5350. Rapid Prototyping. (3) Cross-listed Course(s): ITIS 4350. Introduction to theory and approaches for rapid prototyping in interface design. Explores theoretical constructs behind rapid prototyping and how it relates to Human-Computer Interaction. Students study evolutionary prototyping. This begins with low fidelity prototyping techniques such sketching and paper prototyping, and progressively iterate through higher fidelity prototyping techniques using digital tools. In addition to software prototyping, the course also provides an introduction to physical prototyping.

ITIS 5390. Interaction Design Studio. (3) Prerequisite(s): ITIS 6400; and CCI graduate standing or permission of department. A studio approach to teaching topics in interaction design. Aspects of interaction design taught in the studio include: gesture-based interaction, tangible interaction, large public display interaction, tabletop interaction, multi-touch tablet interaction, and human-robot interaction. Students learn to apply a theoretical understanding of some aspect of interaction design to the study of existing designs and the development of a new design. Outcomes include writing a literature review about interaction design, executing users studies and critiques of existing designs, and developing and implementing a new interaction design for a specific purpose. *May be repeated for credit.*

ITIS 5510. Web Mining. (3) Cross-listed Course(s): DSBA 5510. Pre- or Corequisite(s): ITIS 6120, ITCS 6610, or permission of department. Topics include: measuring and modeling the Web; crawling, Web search and information retrieval; unsupervised learning, supervised learning, semi-supervised learning in Web context; social network analysis and hyperlink analysis; text parsing and knowledge representation.

ITIS 6010. Topics in Software and Information Systems. (3) Prerequisite(s): CCI graduate standing or permission of department. Topics in software and information systems selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

ITIS 6110. Agent-Based Modeling. (3) Cross-listed Course(s): ITIS 8110. Discusses the definition of an agent-based model, the components of a model, the implementation of a model, the comparison of an agent-based model to an equation-based model, the relationship to complex adaptive systems, and the details of how to use NetLogo to actually implement a model. Identifies when agent-based modeling is preferred over equation-based modeling. Also describes similarities and differences between the two techniques. After taking this course, students, once a complex adaptive system has been identified, are able to identify a suitable environment for a model, identify the key agents of the system, identify the key behaviors of those agents, and implement a model to illustrate the complex adaptive nature of the system with NetLogo.

ITIS 6112. Software System Design and Implementation. (3) Cross-listed Course(s): HCIP 6112 and ITCS 6112. Prerequisite(s): CCI graduate standing or permission of department. Introduction to the techniques involved in the planning and implementation of large software systems. Emphasis on human interface aspects of systems. Planning software projects; software design process; top-down design; modular and structured design; management of software projects; testing of software; software documentation; choosing a language for software system.

ITIS 6120. Applied Databases. (3) Cross-listed Course(s): HCIP 5160 and ITIS 8120. Prerequisite(s): CCI graduate standing or permission of department. Identification of business database needs; requirements specification; relational database model; SQL; E-R modeling; database design, implementation, and verification; distributed databases; databases replication; object-oriented databases; data warehouses; OLAP; data mining; security of databases; vendor selection; DBMS product comparison; database project management; tools for database development, integration, and transaction control.

ITIS 6140. Software Testing and Quality Assurance. (3) Prerequisite(s): CCI graduate standing or permission of department. Methods for evaluating software for correctness and reliability including code inspections, program proofs and testing methodologies. Formal and informal proofs of correctness. Code inspections and their role in software verification. Unit and system testing techniques, testing tools and limitations of testing. Statistical testing, reliability models. Software engineering maturity model.

ITIS 6148. Advanced Object-Oriented Design and Implementation. (3) Cross-listed Course(s): ITCS 6148. Prerequisite(s): CCI graduate standing or permission of department. Focuses on issues related to the design, implementation, integration, and management of large object-oriented systems. Topics include: object models, object modeling, frameworks, persistent and distributed objects, and object-oriented databases.

ITIS 6150. Software Assurance. (3) Cross-listed Course(s): ITIS 8150. Prerequisite(s): CCI graduate standing or permission of department. An introduction to software assurance education and research. Topics include: the security of software across the development life cycle that addresses trustworthiness, predictable execution and conformance. Various aspects of secure software requirements, design, construction, verification, and validation, process and engineering management are focused on as they relate to secure software development. Students gain hands-on experience in various techniques and tools as part of a semester-long project in addition to other assignments.

ITIS 6162. Knowledge Discovery in Databases. (3) Cross-listed Course(s): DSBA 6162, HCIP 6162, and ITCS 6162. Prerequisite(s): ITCS 6160 or ITIS 6120. Exploration of the entire knowledge discovery process. Topics include: setting up a problem, data preprocessing and warehousing, data mining in search for knowledge, knowledge evaluation, visualization and application in decision making. A broad range of systems, such as OLAP, LERS, DatalogicR+, C4.5, AQ15, Forty-Niner, CN2, QRAS, and discretization algorithms are also covered.

ITIS 6163. Data Warehousing. (3) Cross-listed Course(s): HCIP 6163 and ITCS 6163. Prerequisite(s): ITCS 6160 or ITIS 6120. Topics include: use of data in discovery of knowledge and decision making; the limitations of relational databases and SQL queries; the warehouse data models: multidimensional, star, snowflake; architecture of data warehouse and the process of warehouse construction; data consolidation from various sources; optimization; techniques for data transformation and knowledge extraction; relations with enterprise modeling.

ITIS 6167. Network Security. (3) Cross-listed Course(s): HCIP 6167. Prerequisite(s): CCI graduate standing or permission of department. Examines the issues related to network security. Topics include: network security background and motivation, network centric threats, network authentication and identification, network security protocols, firewall, IDS, security in wireless environments, email security, instant message security, network application security, and network based storage security. There are heavy lab based components in this course.

ITIS 6177. System Integration. (3) Pre- or Corequisite(s): ITIS 5166 or equivalent, or permission of department. Examines the issues related to system integration. Topics include: data integration, business process integration, integration architecture, middleware, system security, and system management.

ITIS 6180. Foundations of Health Informatics. (3) Cross-listed Course(s): ITIS 8180. Prerequisite(s): Graduate standing in computer science, information technology, health informatics, or related discipline. An overview of foundational concepts and methods in healthcare systems, technologies, and policies that are critical for successful research in health informatics. Students explore recurring themes, issues, and applications most frequently encountered in the field. The course is both technical and rigorous, and will involve both theoretical analysis and substantial projects. Topic include: an overview of issues, systems and technologies in health informatics and in-depth discussion of data standards, data integration, data analytics, and evaluation methods. Students who take this course gain the skills and knowledge necessary to conduct research in health informatics.

ITIS 6198. IT Internship Project. (3) Prerequisite(s): permission of department. Complete a team-based project that is originated from an IT organization and approved by the department.

ITIS 6200. Principles of Information Security and Privacy. (3) Cross-listed Course(s): HCIP 6200 and ITIS 8200. Prerequisite(s): CCI graduate standing or permission of department. Topics include: security concepts and mechanisms; security technologies; authentication mechanisms; mandatory and discretionary controls; basic cryptography and its applications; database security, intrusion detection and prevention; assurance requirement, assurance class, evaluation methods and assurance maintenance; anonymity and privacy issues for information systems.

ITIS 6210. Access Control and Security Architecture. (3) Cross-listed Course(s): HCIP 6210. Prerequisite(s): ITIS 6200 or permission of department. Discusses objectives, formal models, and mechanisms for access control; and access control on commercial off-the-shelf (COTS) systems. Examines the issues related to security architectures and technologies for authorization. Topics include: cryptographic infrastructure, distributed systems security architectures, database systems security architectures, Internet security architectures, network security architectures and e-commerce security architectures.

ITIS 6211. Studio Lab I. (3) Cross-listed Course(s): ARCH 7211 and ITCS 6211. Prerequisite(s): CCI graduate standing or permission of department. The Studio/Lab sequence situates students with varying backgrounds in an educational environment that allows them to develop and test innovative computational design tools, applications and settings. Each semester is jointly taught by faculty from the School of Architecture and the College of Computing and Informatics, and is organized around a topic chosen by the participating faculty. Each focused topic requires expertise both in spatial design and computational design, and results in prototypes and evaluation.

ITIS 6212. Studio Lab II. (3) Cross-listed Course(s): ARCH 7212 and ITCS 6212. Prerequisite(s): CCI graduate standing or permission of department. The Studio/Lab sequence situates students with varying backgrounds in an educational environment that allows them to develop and test innovative computational design tools, applications and settings. Each semester is jointly taught by faculty from School of Architecture and the College of Computing and Informatics, and is organized around a topic chosen by the participating faculty. Each focused topic requires expertise both in spatial design and computational design, and results in prototypes and evaluation.

ITIS 6216. Introduction to Cognitive Science. (3) Cross-listed Course(s): PSYC 6216 and ITCS 6216. Multiple perspectives on the study of intelligent systems. Broad coverage of such topics as philosophy of mind; human memory processes; reasoning and problem solving; artificial intelligence; language processing (human and machine); neural structures and processes; and vision. Also included is participation in the cognitive science seminar.

ITIS 6220. Data Privacy. (3) Pre- or Corequisite(s): ITIS 6200, full graduate standing, or permission of department. Topics include: privacy concepts, policies, and mechanisms; identity, anonymity, and confidentiality; private data analysis and database sanitization; privacy-preserving data mining techniques including k-anonymity, randomization, and secure function evaluation; privacy issues in social networks, RFID, and healthcare applications.

ITIS 6230. Enterprise and Infrastructure Protection. (3) Cross-listed Course(s): HCIP 6230 and ITIS 8230. Prerequisite(s): ITIS 6200 or permission of department. Methodologies, tools, and technologies that are important

for protecting data and network security in both enterprises and critical infrastructures. Topics include: the prevent-detect-response strategy for enterprise security, policies, techniques, processes and methodologies for risk assessment and management, infrastructure reconnaissance and vulnerability analysis, basics of forensics, methodologies for continuous operation and recovery from disasters.

ITIS 6240. Applied Cryptography. (3) Cross-listed Course(s): HCIP 6240. Prerequisite(s): CCI graduate standing or permission of department. Provides students with an understanding of modern cryptographic techniques, algorithms and protocols that are of fundamental importance to the design and implementation of security critical applications. Covers not only standard cryptographic techniques, but also exposes students to the latest advances in applied cryptography. Topics include: secret and public key ciphers, stream ciphers, one-way hashing algorithms, authentication and identification, digital signatures, key establishment and management, secret sharing and data recovery, public key infrastructures, and efficient implementation.

ITIS 6260. Quantum Computing. (3) Cross-listed Course(s): ITIS 8260. Prerequisite(s): Full graduate standing or permission of department. The fundamental concepts and algorithms of quantum mechanics, quantum computation, quantum information theory, and post quantum cryptography. Topics include: quantum mechanics, quantum states, quantum entanglement, quantum measurement, qubits, quantum computation, universal quantum gates, reversible computation, quantum algorithms, quantum Fourier transform, quantum search, quantum computers, quantum noise and quantum operations, quantum error-correction, and post-quantum cryptography.

ITIS 6268. Wireless Network Security. (3) Cross-listed Course(s): ITIS 8268. Prerequisite(s): ITIS 6167 or permission of department. Introduction to state-of-art techniques in wireless security. Topics include: Secure and resilient data aggregation, Key pre-distribution and management, Security in group communication, Trust establishment and management, Denial-of-service attacks, Secure routing, Secure localization and information privacy, and more. The application environments cover mobile ad hoc networks, sensor networks, Internet of Things, Cyber Physical Systems, and Cellular Networks.

ITIS 6270. BlockChain, Cryptocurrency, and Distributed Ledger Technologies. (3) Cross-listed Course(s): ITIS 8270. Prerequisite(s): Full graduate standing or permission of department. Provides an understanding of the fundamental concepts and technologies of distributed ledger technologies (DLT), blockchains, consensus techniques, cryptocurrency, and smart contracts. Topics include: blockchains, cryptocurrency, distributed ledger technologies, smart contract programming languages, and their applications.

ITIS 6320. Cloud Data Storage. (3) Cross-listed Course(s): ITIS 8320. Prerequisite(s): CCI graduate standing or permission of department. The design and implementation of cloud storage and big data systems and the architecture and characteristics of components on which cloud storage systems are built. Topics include: storage device hardware, file systems, mirroring and RAID, array coding techniques, storage area networks (SAN), network-attached storage (NAS), cloud storage and big data, DB in clouds, relational storage models, key value stores and other No-SQL mechanisms, data consistency and availability in the cloud, cloud data privacy and security.

ITIS 6330 Malware Analysis. (3) Cross-listed Course(s): ITIS 8330. Prerequisite(s): ITIS 6200. Introduction to the most important topics in malware analysis, including system security basics, malware concept/classification, attacks, static analysis, dynamic analysis, sandboxes, emulators, and virtual machine introspection. Students finish a series of hands-on labs in order to learn how to use common analysis tools to dissect real-world malware in a prebuilt environment. Students are also exposed to the challenges imposed by malware attempt to evade or thwart analysis.

ITIS 6342. Information Technology Project Management. (3) Cross-listed Course(s): HCIP 6342. Prerequisite(s): CCI graduate standing or permission of department. Introduction to problems associated with managing information technology projects involving, particularly, integration of systems, development of client-specific solutions, and project justification. Moves beyond the classic techniques of project management and integrate communication software/systems, multi-site, multi-client facilities projects, cultural issues involved with managing interdisciplinary teams, and the effect of rapid technological obsolescence on project justification, funding and continuance.

ITIS 6360. User-Centered Design and Evaluation. (3) Cross-listed Course(s): ITIS 8360. Prerequisite(s): ITIS 6400. Designed to teach the user-centered design and evaluation process. In particular, students gain hands-on experience with the process of interface design, methods of design, and ways to evaluate and improve the design of interactive software applications in a course-long project. Students learn how to employ techniques which ensure that end-users are fully considered at all stages of the design process, from inception to implementation. Assignments involve planning, designing, and conducting studies to learn about user needs; developing the protocols and instruments for data collection; brainstorming, prototyping, and refining interactive

solutions for a user problem; and designing and executing user evaluations of interactive software interfaces.

ITIS 6362. Information Technology Ethics, Policy, and Security. (3) Prerequisite(s): CCI graduate standing or permission of department. Management of Information technology involves understanding the broader issues of ethics, policy and security. The growth in Internet usage and E-commerce require IT professionals to consider issues pertaining to data protection, regulation, and appropriate use and dissemination of information. The course is designed to be team-taught by professionals in the field.

ITIS 6370. Interactive Systems Design and Implementation. (3) Cross-listed Course(s): ITIS 8370. Prerequisite(s): ITIS 6350 or ITIS 6400. The implementation of interactive software systems through standard IDE programming environments, with a focus on ensuring that the systems adhere to standard usability principles and are built following scalable programming models, such as the model-view-controller. The assignments in this course focus on desktop/laptop implementations, as opposed to mobile or web application, though the theory is useful across all platforms.

ITIS 6400. Human-Centered Design. (3) Cross-listed Course(s): HCIP 6350 and ITIS 8400. Prerequisite(s): CCI graduate standing or permission of department. Introduces and provides experience in concepts and methods for human-computer interaction, with an emphasis on methods for human-centered design and evaluation of user experiences with IT. Topics include: design principles, need finding, design prototypes, and evaluation of interaction designs to make them compatible with human capabilities and expectation.

ITIS 6410. Personalization and Recommender Systems. (3) Cross-listed Course(s): HCIP 6410 and ITIS 8410. Prerequisite(s): CCI graduate standing or permission of department. An introduction to the application of personalization and recommender systems techniques in information systems. Topics include: historical, individual and commercial perspectives; underlying approaches to content-based and collaborative recommendation techniques for building user models; acceptance issues; and case-studies drawn from research prototypes and commercially deployed systems.

ITIS 6420. Usable Security and Privacy. (3) Cross-listed Course(s): ITIS 8420. Much of the work into security and privacy solutions ignore a critical element: the human who must interact with those solutions. In this course, we investigate privacy and security from a user-centered point of view. How do people think about privacy and security? How do they interact with current applications and solutions? What should be considered in designing user-friendly security systems? This course introduces students to a variety of usability and user interface issues related to privacy and security as well as examine potential designs and solutions.

ITIS 6500. Complex Adaptive Systems. (3) Cross-listed Course(s): DSBA 6500, HCIP 6500, ITCS 6500, ITCS 8500, and ITIS 8500. Prerequisite(s): CCI graduate standing or permission of department. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. This course covers those and similar topics in an interactive manner. Examples of current research efforts are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; and complexity.

ITIS 6510. Software Agent Systems. (3) Cross-listed Course(s): ITIS 8510. Prerequisite(s): CCI graduate standing or permission of department. An introduction to centralized and distributed software agent systems. Topics include: agent cooperation in cooperative and competitive environments, agent architectures, game theoretical models, market mechanisms, multi-agent learning, mixed-initiative computing and single and multi-agent applications. Students gain hands-on experience by building a multi-agent system as part of a semester-long project in addition to shorter assignments.

ITIS 6520. Network Science. (3) Cross-listed Course(s): DSBA 6520, HCIP 6520, and ITIS 8520. Prerequisite(s): CCI graduate standing or permission of department. Network Science helps students design faster, more resilient communication networks; revise infrastructure systems such as electrical power grids, telecommunications networks, and airline routes; model market dynamics; understand synchronization in biological systems; and analyze social interactions among people. It examines the various kinds of networks (regular, random, small-world, influence, scale-free, and social) and applies network processes and behaviors to emergence, epidemics, synchrony, and risk. This course integrates concepts across computer science, biology, physics, social network analysis, economics, and marketing.

ITIS 6530. Systems Dynamics. (3) Cross-listed Course(s): ITIS 8530. Prerequisite(s): CCI graduate standing or permission of department. Introduction to systems thinking and the systems dynamics world view, tools for eliciting and mapping the structure and dynamics of complex systems, tools for modeling and simulation of complex systems, and procedures for testing and improving models. Helps students outline and evaluate dynamic relationships and factors that influence organizations' performance, market position, decision-making, and policy evaluations. Integrates concepts across information systems, computer science, business, engineering, economics, and social sciences. Based on 3-hour weekly lectures and hands-on project assignment.

ITIS 6880. Individual Study. (1 to 3) Prerequisite(s): At least 9 graduate ITCS/ITCS hours and permission of department. With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects. *May be repeated for credit.*

ITIS 6991. Information Technology Thesis. (1 to 6) Prerequisite(s): Full standing in the M.S. in Information Technology program and permission of department. Graduate thesis research. A detailed exploration of an area of information technology chosen for thesis research. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit; no more than 6 credit hours may be applied to the M.S. degree requirements.*

ITIS 6999. SFS Research. (3) Research for CyberCorps Scholarship for Service (SFS) program. *May be repeated for credit; no more than 3 credit hours may be applied to the M.S. degree requirements.*

ITIS 8010. Topics in Software and Information Systems. (3) Prerequisite(s): permission of department. Topics in software and information systems selected to supplement the regular course offerings. *May be repeated for credit with change of topic.*

ITIS 8110. Agent-Based Modeling. (3) Cross-listed Course(s): ITIS 6110. Discusses the definition of an agent-based model, the components of a model, the implementation of a model, the comparison of an agent-based model to an equation-based model, the relationship to complex adaptive systems, and the details of how to use NetLogo to actually implement a model. Identifies when agent-based modeling is preferred over equation-based modeling. Also describes similarities and differences between the two techniques. After taking this course, students, once a complex adaptive system has been identified, are able to identify a suitable environment for a model, identify the key agents of the system, identify the key behaviors of those agents, and implement a model to illustrate the complex adaptive nature of the system with NetLogo.

ITIS 8112. Software System Design and Implementation. (3) Cross-listed Course(s): ITCS 8112. Prerequisite(s): Ph.D. student standing or permission of instructor. Introduction to the techniques involved in the planning and implementation of large software systems. Emphasis on human interface aspects of systems. Planning software projects; software design process; top-down design; modular and structured design; management of software projects; testing of software; software documentation; choosing a language for software system.

ITIS 8120. Applied Databases. (3) Cross-listed Course(s): HCIP 5160 and ITIS 6120. Prerequisite(s): Full graduate standing or permission of department. Identification of business database needs; requirements specification; relational database model; SQL; E-R modeling; database design, implementation, and verification; distributed databases; databases replication; object-oriented databases; data warehouses; OLAP; data mining; security of databases; vendor selection; DBMS product comparison; database project management; tools for database development, integration, and transaction control.

ITIS 8140. Software Testing and Quality Assurance. (3) Prerequisite(s): ITIS 6112 or permission of department. Methods for evaluating software for correctness, and reliability including code inspections, program proofs and testing methodologies. Formal and informal proofs of correctness. Code inspections and their role in software verification. Unit and system testing techniques, testing tools and limitations of testing. Statistical testing, reliability models. Software engineering maturity model.

ITIS 8148. Advanced Object-Oriented Systems. (3) Cross-listed Course(s): ITCS 8112. Prerequisite(s): ITIS 8112 or equivalent. Issues related to the design, implementation, integration, and management of large object-oriented systems. Topics include: object models, object modeling, frameworks, persistent and distributed objects, and object-oriented databases.

ITIS 8150. Software Assurance. (3) Cross-listed Course(s): ITIS 6150. Prerequisite(s): ITCS 6112, ITCS 8112, ITIS 5221, ITIS 6112, ITIS 8112, or permission of department. An introduction to software assurance education and research. Topics include: the security of software across the development life cycle that addresses trustworthiness, predictable execution and conformance. Various aspects of secure software requirements, design, construction, verification, and validation, process and engineering management are focused on as they relate to secure software development. Students gain hands-on

experience in various techniques and tools as part of a semester-long project in addition to other assignments.

ITIS 8163. Data Warehousing. (3) Cross-listed Course(s): ITCS 8163. Prerequisite(s): ITCS 8160 or ITIS 8120. Topics include: use of data in discovery of knowledge and decision making; the limitations of relational databases and SQL queries; the warehouse data models: multidimensional, star, snowflake; architecture of data warehouse and the process of warehouse construction; data consolidation from various sources; optimization; techniques for data transformation and knowledge extraction; relations with enterprise modeling.

ITIS 8167. Network and Information Security. (3) Prerequisite(s): ITCS 6166 or equivalent. Examines the issues related network and information security. Topics include: concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptographic algorithms, security standards, security system interoperation and case studies of the current major security systems.

ITIS 8177. System Integration. (3) Prerequisite(s): Ph.D. student standing, or permission of the department. Examines the issues related to system integration. Topics include: data integration, business process integration, integration architecture, middleware, system security, and system management.

ITIS 8180. Foundations of Health Informatics. (3) Cross-listed Course(s): ITIS 6180. Prerequisite(s): Graduate standing in computer science, information technology, health informatics, or related discipline. An overview of foundational concepts and methods in healthcare systems, technologies, and policies that are critical for successful research in health informatics. Students explore recurring themes, issues, and applications most frequently encountered in the field. The course is both technical and rigorous, and will involve both theoretical analysis and substantial projects. Topic include: an overview of issues, systems and technologies in health informatics and in-depth discussion of data standards, data integration, data analytics, and evaluation methods. Students who take this course gain the skills and knowledge necessary to conduct research in health informatics.

ITIS 8200. Principles of Information Security and Privacy. (3) Cross-listed Course(s): ITIS 6200 and HCIP 6200. Prerequisite(s): permission of department. Topics include: security concepts and mechanisms; security technologies; authentication mechanisms; mandatory and discretionary controls; basic cryptography and its applications; intrusion detection and prevention; information systems assurance; anonymity and privacy issues for information systems.

ITIS 8210. Access Control and Security Architecture. (3) Prerequisite(s): ITIS 8200. Discusses objectives, formal models, and mechanisms for access control; and access control on commercial off-the-shelf (COTS) systems. Examines the issues related to security architectures and technologies for authorization. Topics include: cryptographic infrastructure, distributed systems security architectures, Internet security architectures, network security architectures and e-commerce security architectures.

ITIS 8220. Data Privacy. (3) Pre- or Corequisite(s): ITIS 6200, full graduate standing, or permission of department. Topics include: privacy concepts, policies, and mechanisms; identity, anonymity, and confidentiality; private data analysis and database sanitization; privacy-preserving data mining techniques including k-anonymity, randomization, and secure function evaluation; privacy issues in social networks, RFID, and healthcare applications.

ITIS 8230. Enterprise and Infrastructure Protection. (3) Cross-listed Course(s): HCIP 6230 and ITIS 6230. Prerequisite(s): ITIS 8200. Methodologies, tools, and technologies that are important for protecting data and network security in both enterprises and critical infrastructures. Topics include: the prevent-detect-response strategy for enterprise security, policies, techniques, processes and methodologies for risk assessment and management, infrastructure reconnaissance and vulnerability analysis, basics of forensics, methodologies for continuous operation and recovery from disasters.

ITIS 8240. Applied Cryptography. (3) Prerequisite(s): Graduate standing or permission of department. Provides students with an understanding of modern cryptographic techniques, algorithms and protocols that are of fundamental importance to the design and implementation of security critical applications. The course not only covers standard cryptographic techniques, but also exposes students to the latest advances in applied cryptography. Topics include: secret and public key ciphers, stream ciphers, one-way hashing algorithms, authentication and identification, digital signatures, key establishment and management, secret sharing and data recovery, public key infrastructures, and efficient implementation.

ITIS 8260. Quantum Computing. (3) Cross-listed Course(s): ITIS 6260. Prerequisite(s): Full graduate standing or permission of department. The fundamental concepts and algorithms of quantum mechanics, quantum computation, quantum information theory, and post quantum cryptography. Topics include: quantum mechanics, quantum states, quantum entanglement, quantum measurement, qubits, quantum computation, universal quantum gates, reversible computation, quantum

algorithms, quantum Fourier transform, quantum search, quantum computers, quantum noise and quantum operations, quantum error-correction, and post-quantum cryptography.

ITIS 8268. Wireless Network Security. (3) Cross-listed Course(s): ITIS 6268. Prerequisite(s): ITIS 6167 or permission of department. Introduction to state-of-art techniques in wireless security. Topics include: Secure and resilient data aggregation, Key pre-distribution and management, Security in group communication, Trust establishment and management, Denial-of-service attacks, Secure routing, Secure localization and information privacy, and more. The application environments cover mobile ad hoc networks, sensor networks, Internet of Things, Cyber Physical Systems, and Cellular Networks.

ITIS 8270. BlockChain, Cryptocurrency, and Distributed Ledger Technologies. (3) Cross-listed Course(s): ITIS 6270. Prerequisite(s): Full graduate standing or permission of department. Provides an understanding of the fundamental concepts and technologies of distributed ledger technologies (DLT), blockchains, consensus techniques, cryptocurrency, and smart contracts. Topics include: blockchains, cryptocurrency, distributed ledger technologies, smart contract programming languages, and their applications.

ITIS 8320. Cloud Data Storage. (3) Cross-listed Course(s): ITIS 6320. Prerequisite(s): Full graduate standing or permission of department. The design and implementation of cloud storage and big data systems and the architecture and characteristics of components on which cloud storage systems are built. Topics include: storage device hardware, file systems, mirroring and RAID, array coding techniques, storage area networks (SAN), network-attached storage (NAS), cloud storage and big data, DB in clouds, relational storage models, key value stores and other No-SQL mechanisms, data consistency and availability in the cloud, cloud data privacy and security.

ITIS 8330 Malware Analysis. (3) Cross-listed Course(s): ITIS 6330. Prerequisite(s): ITIS 8200. Introduction to the most important topics in malware analysis, including system security basics, malware concept/classification, attacks, static analysis, dynamic analysis, sandboxes, emulators, and virtual machine introspection. Students finish a series of hands-on labs in order to learn how to use common analysis tools to dissect real-world malware in a prebuilt environment. Students are also exposed to the challenges imposed by malware attempt to evade or thwart analysis.

ITIS 8342. Information Technology Project Management. (3) Prerequisite(s): permission of department. Introduces the student to problems associated with managing information technology projects involving, particularly, integration of systems, development of client-specific solutions, and project justification. The course will move beyond the classic techniques of project management and integrate communication software/systems, multi-site, multi-client facilities projects, cultural issues involved with managing interdisciplinary teams, and the effect of rapid technological obsolescence on project justification, funding and continuance.

ITIS 8350. Rapid Prototyping with HCI Design Patterns. (3) Designed to teach the Rapid Prototyping Design Patterns process. An active learning course designed to expose students to the many forms of rapid prototyping software and devices. The focus is on the use of common design patterns and how to represent them quickly and inexpensively for the purpose of allowing many rapid design iterations prior to the coding of solutions. This course can be considered a communication course where communication between designers and developers occurs through prototyped artifacts and accompanying documentation. Design patterns can be considered the vocabulary of interaction and interface design, and so learning this vocabulary is an important aspect of the course. Prototyping in this course spans all types of devices and platforms: desktop, mobile, web, tabletop, tablet, etc. The theory of rapid prototyping is covered in video lectures that are consumed as part of the student's preparation outside of class. Class time is devoted to hands-on practice of the various rapid prototyping methods. Assignments involve applying the techniques learned in class to a variety of problem spaces and platforms, and the peer-critique of other student's designs. Evaluation is based on both understanding of the theory and on the methodological skills gained, as demonstrated through the individual or paired assignments. Students are also expected to write a scholarly article that examines some aspect of prototyping as a part of the design process.

ITIS 8360. User-Centered Design and Evaluation. (3) Cross-listed Course(s): ITIS 6360. Prerequisite(s): ITIS 6400 or ITIS 8400. Designed to teach the user-centered design and evaluation process. In particular, students gain hands-on experience with the process of interface design, methods of design, and ways to evaluate and improve the design of interactive software applications in a course-long project. Students learn how to employ techniques which ensure that end-users are fully considered at all stages of the design process, from inception to implementation. Assignments involve planning, designing, and conducting studies to learn about user needs; developing the protocols and instruments for data collection; brainstorming, prototyping, and refining interactive solutions for a user problem; and designing and executing user evaluations of interactive software interfaces.

ITIS 8362. Information Technology Ethics, Policy, and Security. (3) Prerequisite(s): HADM 6152, MBAD 6121, or MPAD 6120. Management of information technology involves understanding the broader issues of ethics, Policy and Security. The growth in Internet usage and E-commerce require IT professionals to consider issues pertaining to data protection, regulation, and appropriate use and dissemination of information. The course is designed to be team-taught by professionals in the field.

ITIS 8370. Interactive Systems Design and Implementation. (3) Cross-listed Course(s): ITIS 6370. Prerequisite(s): ITIS 8350 or ITIS 8400. The implementation of interactive software systems through standard IDE programming environments, with a focus on ensuring that the systems adhere to standard usability principles and are built following scalable programming models, such as the model-view-controller. The assignments in this course focus on desktop/laptop implementations, as opposed to mobile or web application, though the theory is useful across all platforms.

ITIS 8400. Human-Centered Design. (3) Cross-listed Course(s): ITIS 6400. Prerequisite(s): Full graduate standing or permission of department. Introduces and provides experience in concepts and methods for human-computer interaction, with an emphasis on methods for human-centered design and evaluation of user experiences with IT. Topics include: design principles, need finding, design prototypes, and evaluation of interaction designs to make them compatible with human capabilities and expectation.

ITIS 8410. Personalization and Recommender Systems. (3) Cross-listed Course(s): HCIP 6410 and ITIS 6410. Prerequisite(s): Full graduate standing or permission of department. Introduction to the application of personalization and recommender systems techniques in information systems. Topics include: historical, individual and commercial perspectives; underlying approaches to content-based and collaborative recommendation techniques for building user models; acceptance issues; and case-studies drawn from research prototypes and commercially deployed systems.

ITIS 8420. Usable Security and Privacy. (3) Cross-listed Course(s): ITIS 6420. Much of the work into security and privacy solutions ignore a critical element: the human who must interact with those solutions. In this course, we investigate privacy and security from a user-centered point of view. How do people think about privacy and security? How do they interact with current applications and solutions? What should be considered in designing user-friendly security systems? This course introduces students to a variety of usability and user interface issues related to privacy and security as well as examine potential designs and solutions.

ITIS 8500. Complex Adaptive Systems. (3) Cross-listed Course(s): DSBA 6500, HCIP 6500, ITCS 6500, ITCS 8500, and ITIS 6500. Prerequisite(s): Permission of instructor. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Covers these and similar topics in an interactive manner. Examples of our current research effort will be provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity.

ITIS 8510. Software Agent Systems. (3) Cross-listed Course(s): ITIS 6510. Prerequisite(s): Full graduate standing or permission of department. Introduction to centralized and distributed software agent systems. Topics include: agent cooperation in cooperative and competitive environments, agent architectures, game theoretical models, market mechanisms, multi-agent learning, mixed-initiative computing and single and multi-agent applications. The students will gain hands-on experience by building a multi-agent system as part of a semester-long project in addition to shorter assignments.

ITIS 8520. Network Science. (3) Cross-listed Course(s): DSBA 6520, HCIP 6520, and ITIS 6520. Prerequisite(s): Full graduate standing or permission of department. Network Science helps students design faster, more resilient communication networks; revise infrastructure systems such as electrical power grids, telecommunications networks, and airline routes; model market dynamics; understand synchronization in biological systems; and analyze social interactions among people. It examines the various kinds of networks (regular, random, small-world, influence, scale-free, and social) and applies network processes and behaviors to emergence, epidemics, synchrony, and risk. This course integrates concepts across computer science, biology, physics, social network analysis, economics, and marketing.

ITIS 8530. Systems Dynamics. (3) Cross-listed Course(s): ITIS 6530. Prerequisite(s): CCI graduate standing or department approval. Introduction to systems thinking and the systems dynamics world view, tools for eliciting and mapping the structure and dynamics of complex systems, tools for modeling and simulation of complex systems,

and procedures for testing and improving models. Helps students outline and evaluate dynamic relationships and factors that influence organizations' performance, market position, decision-making, and policy evaluations. Integrates concepts across information systems, computer science, business, engineering, economics, and social sciences. Based on 3-hour weekly lectures and hands-on project assignment.

Computing and Information Systems (ITSC)

ITSC 8110. Introduction to Computing and Information Systems Research. (3) Prerequisite(s): Good standing in the Ph.D. in Computing and Information Systems Program. Computing and Information Systems has a wide range of research areas encompassing the fields of Business Information Systems, Bioinformatics, Computer Science, and Software and Information Systems. This seminar is intended to give Ph.D. in Computing and Information Systems students a sound understanding of the different research areas in Information Technology. The seminar is to be taken during the first year of studies and is intended to be the gateway to the fields within Information Technology and will enable students to select the fields matching their interests early in their studies. Through attending weekly in-depth research presentations from faculty in all participating units in the Ph.D. in Computing and Information Systems program and conducting literature surveys in areas of interest, students are expected to gain the knowledge they need to identify the areas of interest for themselves.

ITSC 8123. Applied Management Science. (3)
Prerequisite(s): MBAD 6122. Mathematical model building aimed at integrating methods and applications. Overview of mathematical programming in practice and a series of projects implementing models in business and the public sector.

ITSC 8141. Operations Management. (3) Prerequisite(s): MBAD 5141 and MBAD 5142 or equivalents. Design, operation, and control of service and manufacturing systems. Emphasis on using analytical tools for problem solving in process analysis and re-engineering, work-force management, materials and inventory management, aggregate planning, total quality management, and others

ITSC 8142. Quality and Manufacturing Management. (3)
Prerequisite(s): MBAD 6141. Current issues and advances in operations management including just-in-time inventory management, total quality management, continuous improvement, flexible manufacturing systems, computer integrated manufacturing systems, technology evaluation and selection, and operations strategy.

ITSC 8665. Graduate Teaching Seminar. (1) Preparation for an academic teaching career, by examining communication and teaching techniques in the field of Computer Science. Aims to help students develop pedagogical skills, learn about relevant research in computer science education, and practice teaching strategies in a supportive environment while benefitting from peer feedback.

ITSC 8699. Graduate Research Seminar. (1) Prerequisite(s): Good standing in the Ph.D. in Computing and Information Systems program. Exposes students to current research in Computing and Information Systems through attending weekly research presentations by other students, CIS faculty, and invited speakers. Each student is expected to give at least one presentation for the Graduate Research Seminar before graduation. Students must sign up for and receive credit for the Graduate Research Seminar every semester that they are in the Ph.D. in Computing and Information Systems program until they are admitted to Ph.D. candidacy (i.e., after the students have successfully defended the dissertation proposal). *Graded on Pass/Unsatisfactory basis. May be repeated for credit.*

ITSC 8880. Individual Study. (3) Prerequisite(s): permission of department. With the direction of a faculty member, students plan and implement appropriate objectives and learning activities to develop specific areas of expertise through research, reading, and individual projects. *May be repeated for credit.*

ITSC 8990. Pre-Dissertation Research. (1 to 6)
Prerequisite(s): Good standing in the Ph.D. in Computing and Information Systems program. Students conduct research in information technology under the direction of one or more CIS faculty. A major goal of this course is to prepare the student for the Qualifying Examination. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

ITSC 8991. Doctoral Dissertation Research. (1 to 9)
Individual investigation culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit; students may register for multiple sections of this course in the same semester or different semesters.*

Kinesiology (KNES)

KNES 5100. Organization and Administration of Strength and Conditioning. (3) Cross-listed Course(s): EXER 4100. Prerequisite(s): Enrollment in M.S. in Kinesiology program. Provides the knowledge and skills pertaining to the organization, administration, and oversight of Strength and

Conditioning programs, including facility design, assessing program needs, safety, legal, and ethical issues.

KNES 5115. Research Methods in Kinesiology. (3) Cross-listed Course(s): KNES 4115. Methods of inquiry for research are explored and critiqued within the fields of kinesiology. Emphasis is on developing skills useful for conducting and evaluating basic, applied, and clinical.

KNES 5232. Physiology of Human Aging. (3) Focuses on the normal physiological alterations that occur as the human progresses from a young adult to the latter stages of life. Special attention is given to interventions commonly promoted to combat the physiological changes that result from aging.

KNES 5333. Sport and Exercise Psychology. (3) Cross-listed Course(s): EXER 4333. Prerequisite(s): Enrollment in M.S. in Kinesiology or B.S. in Exercise Science program. An examination of psychosocial theories and research related to sport and exercise behavior. Aims for an understanding on the psychological factors that influence participation and performance of exercise.

KNES 6099. Special Topics in Kinesiology. (1 to 3) Topics and special problems related to issues, practices or sufficient trends in kinesiology. Institutes, workshops, seminars, and independent studies. Course *May be repeated for credit with change of topic.*

KNES 6110. Assessment of Physical Activity Across the Lifespan. (3) Prerequisite(s): Enrollment in MPH or M.S. in Kinesiology. Adequate physical activity is one of the best characterized and effective preventative medicines. Students learn how to assess physical activity behaviors and physical fitness levels of persons across the lifespan. The class combines lecture and active learning elements to give students practical experience with relevant survey tools and fitness assessments.

KNES 6120. Advances in Clinical Exercise Physiology. (3) Introduces concepts and topics associated with Clinical Exercise Physiology, including areas of practice in Clinical Exercise Physiology and professional development.

KNES 6121. Clinical Practice in Exercise Physiology. (3) Knowledge and skills required in the clinical setting including operational standards, examination of current drug therapies, and legal and social considerations related to practice as a Clinical Exercise Physiologist.

KNES 6134. Exercise Prescription for Cardiopulmonary and Metabolic Disorders. (3) Study of responses and adaptations to exercise, assessment techniques, exercise prescription, leadership and programming.

KNES 6151. Exercise Testing Methods. (3) Introduces the basic Exercise Testing methods used by Clinical Exercise Physiologists. Focuses on the theory and application of specific skills, as well as developing clinical proficiency in assessing outcomes of physiologic function and fitness.

KNES 6170. Neuromechanics of Gait and Posture. (3) The influence of central and peripheral mechanisms on gait and posture are emphasized by reviewing experimental protocols that have perturbed human movement. Instruction includes both normal and pathological studies, and the effect that interventions may have on disturbances in gait and posture.

KNES 6171. Advanced Biomechanics. (3) Prerequisite(s): Enrollment in M.S. in Kinesiology program or permission of instructor. Introduces the laws of basic mechanics and physics affecting human movement. An emphasis is placed on the mechanical principles pertaining to exercise, sport, and physical activity. Students are exposed to the principles that govern human movement through studying the application of mechanical principles in skill analysis for performance and injury prevention.

KNES 6260. Clinical Exercise Nutrition. (3) Principles of nutrition, dietary guidelines, dietary relationships to diseases and health, special populations, computerized dietary analysis.

KNES 6280. Advanced Exercise Physiology. (3) Advanced study of the functioning of physiological systems during exercise with emphasis on current literature and research.

KNES 6282. Skeletal Muscle for Health and Disease. (3) Prerequisite(s): Enrollment in M.S. in Kinesiology program or permission of instructor. Increase breadth of knowledge on skeletal muscle structure, signaling processes, and function from the molecular level to the whole organ. Students learn the plasticity of muscle during scenarios of growth, disuse, exercise, aging, and disease.

KNES 6285. Advanced Cardiopulmonary Physiology. (3) Provides a thorough understanding of cardiovascular physiology, ECG interpretation, and health-related applications. Examines in detail the various parameters of the cardiovascular system, the implication of disease and structural abnormalities to these parameters, and the relationship of cardiovascular function to exercise adaptation. Emphasis is placed on usage of the information in the clinical setting.

KNES 6292. Exercise Prescription for Musculoskeletal Disorders. (3) Advanced study of the clinical applications of common therapeutic modalities and rehabilitation in the treatment of injuries and illnesses associated with physical activity.

KNES 6320. Advanced Principles of Strength and Conditioning. (3) Prerequisite(s): Enrollment in M.S. in Kinesiology program or permission of instructor. Introduces advanced scientific principles that govern the development of strength and conditioning programs. Emphasizes the evidence-guided development and implementation of programs that increase strength, aerobic capacity, flexibility, speed, and agility. Prepares students for nationally recognized certifications, such as the National Strength and Conditioning exams.

KNES 6333. Pedagogy for Teaching Assistants. (3) Prerequisite(s): Permission of department. Introduces pedagogy skills to first-semester graduate teaching assistants in the Department of Applied Physiology, Health, and Clinical Sciences. Students are guided to develop and apply their teaching philosophy towards planning, implementing, and evaluating lessons on lectures, physical activities, and clinical labs.

KNES 6340. Periodization of Resistance Training. (3) Prerequisite(s): Enrollment in M.S. in Kinesiology program or permission of instructor. Introduces the theoretical concepts and applications of constructing optimal strength training programs for a large number of different types of athletes. Examines various strategies to manipulate the strength training program for optimal performance. Further prepares students for the CSCS examination offered by the NSCA.

KNES 6490. Advanced Practicum in Clinical Exercise Physiology. (1) Prerequisite(s): Permission of instructor. Acquisition and application of knowledge, skills, and abilities necessary for the Registered Clinical Exercise Physiologist while gaining experiential hours in an appropriate clinical setting. *May be repeated for credit up to 6 credits.*

KNES 6800. Directed Independent Study. (1 to 3) Directed study in areas of specialization in kinesiology and related fields. *Graded on a Pass/Unsatisfactory basis.*

KNES 6900. Research and Thesis in Kinesiology. (3) Prerequisite(s): KNES 6115 and permission of instructor overseeing thesis research. Design, implementation, presentation, and evaluation of an approved research project in student's specialty area. The applied project is under the supervision of an advisor and graduate committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

KNES 7999. Master's Degree Graduate Residency Credit. (1) Meets Graduate School requirement for continuous enrollment during final term prior to graduation when all coursework has been completed.

Languages and Culture Studies (LACS)

LACS 5050. Topics in Foreign Language. (3) Selected topics in field of interest related to a variety of languages. *May be repeated at UNC Charlotte for credit with change of topic. May be repeated once for Study Abroad credit with change of topic.*

Latin American Studies (LTAM)

LTAM 5000. Graduate Topics in Latin American Studies. (3) Intensive treatment of a topic in Latin American Studies, depending on student needs and staff resources. *May be repeated for credit with change of topic.*

LTAM 5116. Culture and Conflict in the Amazon. (3) Cross-listed Course(s): ANTH 4616. Examines Brazilian development strategies in the Amazon and explores how these policies have affected both the environment and the various populations living in the Amazon. Topics covered include environmental degradation, human rights abuses, culture change, migration, and globalization.

LTAM 5120. Advanced Business Spanish I. (3) Cross-listed Course(s): SPAN 5120. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Advanced studies in Business Spanish, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as economics, management, and marketing.

LTAM 5121. Advanced Business Spanish II. (3) Cross-listed Course(s): SPAN 5121. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, courses or permission of the department. Advanced studies in Business Spanish, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as marketing, finance, and import-export.

LTAM 5310. Studies in Spanish American Poetry. (3) Cross-listed Course(s): SPAN 5210. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Studies of 19th and 20th century Spanish American poetry.

LTAM 5311. Studies in Spanish American Prose Fiction. (3) Cross-listed Course(s): SPAN 5011. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Studies of 19th and 20th century Spanish American prose fiction.

LTAM 5312. Studies in Spanish American Theater. (3) Cross-listed Course(s): SPAN 5212. Prerequisite(s):

Permission of the department. Studies of 20th century Spanish American theater.

LTAM 5600. Seminar in Latin American Studies. (3) Cross-listed Course(s): LTAM 4600. A seminar involving in-depth research and analysis of a topic suitable for interdisciplinary study and exploration of a variety of methodological approaches. *May be repeated for credit with change of topic.*

LTAM 6000. Advanced Graduate Topics in Latin American Studies. (3) Intensive treatment of a topic in Latin American Studies, depending on student needs and staff resources. *May be repeated for credit with change of topic.*

LTAM 6100. Seminar in Latin American Politics. (3) An analysis of contemporary Latin American politics

LTAM 6250. Comparative Slavery and Race Relations. (3) Cross-listed Course(s): HIST 6250. Prerequisite(s): Permission of the department. Slavery in the New World through its abolition including Indian and African slaves, the slave trade, the economics of slavery, and the impact of slavery on modern race relations in the Americas.

LTAM 6251. Seminar in Colonial Latin American History. (3) Cross-listed Course(s): HIST 6201. Prerequisite(s): Permission of the department. A seminar devoted to selected themes in colonial Latin American history. Provides an introduction to research methods, documentary sources, and the critical analysis of historical literature. Topics will change. *May be repeated for credit.*

LTAM 6252. Seminar in Modern Latin American History. (3) Cross-listed Course(s): HIST 6202. Prerequisite(s): Permission of the department. A seminar devoted to selected themes in modern Latin American history. This course provides an introduction to research methods, documentary sources, and the critical analysis of historical literature. Topics will change. *May be repeated for credit.*

LTAM 6300. Seminar in Latin American Thought. (3) An examination of Latin American thought from the Spanish Conquest to the present day. Emphasis on colonialism and post-colonialism as well as ethnic, racial, class, national, and gender identity

LTAM 6307. Advanced Studies in Spanish American Literature. (3) Cross-listed Course(s): SPAN 6007. Prerequisite(s): Permission of the department. Study of selected works, writers, literary genres, periods, and schools from Spanish America. *May be repeated for credit with change of topic.*

LTAM 6350. Histories of Latin American Architecture. (3) Cross-listed Course(s): ARCH 6050. Surveys the ways by which Latin American architectures (both north and south of the US/Mexico border) have come to be seen within the western canon. In this sense, this course is not purely historical; rather, the course will explore Latin American architectures chronologically but from a post-colonial perspective rooted in the present

LTAM 6400. Internship. (1 to 3) Prerequisite(s): Permission of the department. Supervised work experience in Latin America or related to Latino/a and Latin American Studies issues in the Charlotte area, accompanied by a written project.

LTAM 6800. Directed Readings. (3) Prerequisite(s): prior written permission of instructor and Director of Latin American Studies. Coverage of topics through individually designed reading programs and scheduled conferences with a faculty member. *May be repeated for credit.*

LTAM 6801. Directed Research. (3) Prerequisite(s): prior written permission of instructor and Director of Latin American Studies. Investigation of a topic in Latin American Studies culminating in a research paper.

LTAM 6910. Thesis Tutorial. (3) Independent study with a faculty advisor chosen by the student to conduct research for the M.A. thesis.

LTAM 6920. Master's Thesis. (3) Preparation of the master's thesis under the supervision of the thesis committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term.*

LTAM 6950. Comprehensive Examination (3) Preparation for and completion of the comprehensive exam option of the M.A. in Latin American Studies based on a reading list compiled in consultation with three examiners from at least two different departments.

Liberal Studies (MALS)

MALS 6000. Topics in Liberal Studies. (3) Selected topics approached from interdisciplinary perspectives in the liberal arts. *May be repeated for credit with change of topic.* Examples include interrelated courses forming program emphases on Language and Culture and on Religious Ideas in Physical Forms.

MALS 6101. The Liberal Arts Tradition. (3) An interdisciplinary course focused on a relevant liberal studies topic in the humanities or social sciences. Students learn to critically read across disciplines and to understand the research methods that are covered in liberal studies.

MALS 6102. Writing and Thinking Across the Disciplines. (3) Explores one research topic important across a wide variety of disciplines, allowing students to expand their writing and theorizing skills about a personal research topic of interest. Students are challenged to evaluate and expand their research problem (and others) from a variety of conceptual frameworks. These activities are designed to make students think about their research from different perspectives and thereby increase critical and creative research skills. The course also engages in activities to improve both written and oral communication about their research. Students write and present a literature review on their topic as the culminating graded activity. *May be repeated for credit with permission of the Graduate Program Director.*

MALS 6600. Liberal Studies Capstone Seminar. (3) An integration of the coursework previously taken. Students complete a substantial Capstone Project, working with their Capstone Project Director. As the culmination of this course, students defend their project at an oral defense with the Director and two additional faculty committee members. This course is to be completed in the student's final semester of study.

MALS 6890. Directed Reading/Research. (1 to 3) Prerequisite(s): Prior written permission of instructor and MALS Director. Graduate students meet individually or in small groups with the instructor and will be assigned readings and/or research on an interdisciplinary theme. Attendance at the lectures is a course requirement. *May be repeated for credit with permission of the MALS director.*

Mathematics Education (MAED)

MAED 5000. Topics in Mathematics Education, Early Childhood. (1 to 6) Prerequisite(s): Permission of department. Major topics in early childhood mathematics education. *May be repeated for credit with change of topic.*

MAED 5040. Topics in Mathematics Education, Intermediate. (1 to 6) Prerequisite(s): Permission of department. Major topics in mathematics education involving intermediate grades. *May be repeated for credit with change of topic.*

MAED 5070. Topics in Mathematics Education, Secondary. (1 to 6) Prerequisite(s): Permission of department. Major topics in mathematics education involving secondary education. *May be repeated for credit with change of topic.*

MAED 5101. Arithmetic in the School. (3) Prerequisite(s): MATH 1100 or equivalent. A study of the number systems with emphasis placed upon the basic concepts and meanings, properties of addition, multiplication, inverses, systems of numeration and number line appropriate for each grade. (Does not count toward a major in mathematics. Open only to transfer students who have completed six credit hours of mathematics at another university.)

MAED 5104. Microcomputing for Teachers. (3) Prerequisite(s): working knowledge of college algebra and trigonometry, and permission of department. Introduction to basic computer concepts, to microcomputer systems, to the design and development of programs to assist instruction in mathematics and computer sciences. A programming language such as BASIC or LOGO will be used. Students integrate skills learned by selecting, designing and developing a specific project. (No prior experience with computer programming required.)

MAED 5105. Geometry for Teachers. (3) Prerequisite(s): MATH 2102, MAED 5101, or permission of department. A study of the foundations of Euclidean geometry and a brief treatment of non-Euclidean geometry. Emphasis on learning activities and teaching techniques for teachers of mathematics K-12.

MAED 5141. Mathematics for the Intermediate School Teacher. (3) Prerequisite(s): MATH 2102 or permission of department. A study of the algebraic properties of the real numbers; functions, equations, inequalities and their graphs, activities and applications related to upper elementary and intermediate grades.

MAED 5252. Teaching Mathematics to Secondary School Learners. (3) Cross-listed Course(s): MAED 4252. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Corequisite(s): MDSK 5100L. The initial teaching methods course for secondary school mathematics teachers. Focuses on secondary school mathematics and its relation to the K-12 curriculum. Topics include: the planning and implementation of high quality mathematics lessons with an emphasis on problem solving, mathematical connections, and communication, including school-based field experiences.

MAED 5232. Teaching Mathematics to Middle School Learners. (3) Prerequisite(s): Admission to the MAT Program (Middle Grades mathematics emphasis) or permission of department. Initial teaching methods course for middle school mathematics teachers. Focuses on secondary school mathematics and its relation to the K-12 curriculum. Topics include: the development of teaching strategies and activities in middle school mathematics with an emphasis on problem solving, mathematical connections, communication and assessment, including school-based field experiences.

MAED 6122. Theoretical Foundations of Learning Mathematics. (3) Cross-listed Course(s): EDCI 8122. Prerequisite(s): Admission into the M.S. in Mathematics with Concentration in Mathematics Education program. Introduction to theories of learning that have influenced the teaching of mathematics in K-12. An overview of theories that have guided reforms in mathematics teaching; contemporary constructivist theories of mathematics learning.

MAED 6123. Research in Mathematics Education. (3) Cross-listed Course(s): EDCI 8123. Prerequisite(s): Admission into the M.S. in Mathematics with Concentration in Mathematics Education program. An introduction and overview of research in the teaching and learning of mathematics in K-12. Overview of contemporary research perspectives and paradigms; interpreting and synthesizing the research literature; survey of contemporary research problems in mathematics teaching and learning; development of classroom-based research studies.

MAED 6124. Issues in the Teaching of Secondary School Mathematics. (3) Cross-listed Course(s): EDCI 8124. Prerequisite(s): Admission into the M.S. in Mathematics with Concentration in Mathematics Education program. Study of major issues affecting secondary mathematics education: analysis of the impact of learning theories on methods of teaching; assessment methods for improving mathematics learning; analysis of the historical and programmatic development of the secondary school mathematics curriculum leading to current trends, issues, and problems; and analysis of the role of technology in the secondary mathematics classroom.

MAED 6252. Advanced Methods in Middle and Secondary Mathematics Education. (3) Prerequisite(s): Enrollment in the MAT or M.Ed. program. Examination of current research and scholarship on the teaching of mathematics in middle and secondary schools. Particular emphasis on the development of advanced instructional expertise and leadership.

MAED 8124. Advanced Topics in Mathematics Education. (3) Prerequisite(s): Enrollment in the Mathematics Education specialization of the Ph.D. in Curriculum and Instruction program. Advanced research topics in the teaching and learning of mathematics. Includes a survey, interpretation, and synthesis of contemporary research problems in mathematics teaching and learning. *May be repeated for credit with change of topic.*

MAED 8160. Readings in Mathematics Education. (3) Prerequisite(s): Enrollment in the Mathematics Education specialization of the Ph.D. in Curriculum and Instruction program. Readings in the teaching and learning of mathematics K-16; analysis of the historical development of the K-16 mathematics curriculum leading to current trends, issues, and problems; theory, methods, and techniques for assessment; and analysis of contemporary issues impacting the teaching of mathematics.

Mathematics (MATH)

MATH 5000. Topics in Foundations or History of Mathematics. (2 to 3) Prerequisite(s): Permission of department. Topics in the foundations or the history of mathematics selected to supplement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.* Credit for the M.A. degree in mathematics requires approval of the department.

MATH 5040. Topics in Analysis. (2 to 3) Prerequisite(s): Permission of department. Topics in the foundations or the history of mathematics selected to supplement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.* Credit for the M.A. degree in mathematics requires approval of the department.

MATH 5060. Topics in Algebra. (2 to 3) Prerequisite(s): Permission of department. Topics in algebra selected to supplement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.* Credit for the M.A. degree in mathematics requires approval of the department.

MATH 5080. Topics in Geometry and Topology. (3) Prerequisite(s): Permission of department. Topics in geometry or topology selected to supplement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.* Credit for M.A. degree in mathematics requires approval of the department.

MATH 5109. History of Mathematical Thought. (3) Prerequisite(s): MATH 1241 or permission of department. A study of the development of mathematics in its historical setting from the earliest beginnings to modern times. Not approved for the M.A. in mathematics degree.

MATH 5128. Applied Probability I. (3) Prerequisite(s): MATH/STAT 3122 and MATH 2171 or permission of department. Finite and countable Markov chains, Markov Decision Processes, and optimal stopping. Other topics selected from: queuing theory, inventory models, reliability theory, game theory, recurrent events, information theory, stochastic control, stochastic control with incomplete information and Kalman filtering.

MATH 5129. Applied Probability II. (3) Prerequisite(s): MATH 5128 or permission of department. Continuation of MATH 5128.

MATH 5143. Analysis I. (3) Prerequisite(s): MATH 3141 with grade of B or above, or permission of department. First course of a two-semester sequence providing a rigorous treatment of continuity, differentiability, and integration of functions of one and several real variables.

MATH 5144. Analysis II. (3) Prerequisite(s): MATH 5143 with a grade of B or above or permission of department. Continuation of MATH 5143.

MATH 5161. Number Theory. (3) Prerequisite(s): MATH 3163 with a grade of C or above or permission of department. A study of the elements of classical number theory including divisibility, congruences, diophantine equations, prime numbers and their distribution, quadratic reciprocity, number-theoretic functions, and famous unsolved problems. Not approved for the M.A. in mathematics degree.

MATH 5163. Modern Algebra. (3) Prerequisite(s): MATH 3163 or permission of department. Groups, rings, integral domains, fields.

MATH 5164. Abstract Linear Algebra. (3) Prerequisite(s): MATH 3163 and 2164 or permission of department. Vector spaces over arbitrary fields, linear transformations, canonical forms, multilinear algebra.

MATH 5165. Numerical Linear Algebra. (3) Prerequisite(s): ITCS 1214, MATH 2164 and MATH 2171, all with a grade of C or above, or permission of department. Gaussian elimination and LU decomposition methods for linear systems. Vector and matrix norms, condition numbers, and accuracy of solutions. Solutions of large sparse matrix systems using skyline solvers, and Jacobi, Gauss-Seidel, and SOR iterative methods. Solution of nonlinear systems. Least squares methods using the QR factorization. Selected problems are programmed for computer solution.

MATH 5171. Numerical Solution of Ordinary Differential Equations. (3) Prerequisite(s): ITCS 1214, MATH 2241, 2164, and 2171, all with a grade of C or above, or permission of department. Numerical solution techniques for ordinary differential equations such as Runga-Kutta, multistep, and extrapolation methods. Stiff solvers and stability criteria. Comparative work with modern robust codes and visualization methods.

MATH 5172. The Finite Element Method. (3) Prerequisite(s): ITCS 1214, MATH 2241, MATH 2164, and MATH 2171 with grades of C or above, or permission of department. Boundary value problems and their variational form. Finite element basis functions, computational techniques, isoparametric elements and curved boundaries, alternate methods, singular problems, eigenvalue problems. Some practical experience with an F.E.M. program and graphical output.

MATH 5173. Ordinary Differential Equations. (3) Prerequisite(s): MATH 2171 and MATH 3142, or permission of department. Existence and uniqueness theorems for initial value problems; continuous dependence of solutions on initial values and right hand sides; linear differential equations in R^2 and R^n; nonlinear differential equations in R^2 and R^n: phase portraits, singularities, cycles; invariant manifolds; linearization; singularities of planar systems; Lyapunov stability; examples: van der Pol oscillator, Liénard systems, Volterra-Lotka equations.

MATH 5174. Partial Differential Equations. (3) Prerequisite(s): MATH 2164, MATH 2171, and MATH 3141, or permission of department. Classification of types of partial differential equations. Separation of variables, Sturm-Liouville problems, boundary and eigenvalue problems, fundamental solutions and Green's theorem, Fourier series and integrals, Laplace transforms.

MATH 5176. Numerical Methods for Partial Differential Equations. (3) Prerequisite(s): ITCS 1214, MATH 2241, MATH 2164, and MATH 2171, all with grade of C or above, or permission of department. Basic finite difference schemes for the solutions of elliptic, parabolic and hyperbolic equations. Von Neumann analysis, characteristics, boundary conditions.

MATH 5181. Introduction to Topology. (3) Prerequisite(s): MATH 2164 with a grade of C or above. Topics from set theory and point set topology such as cardinality, order, topological spaces, metric spaces, separation axioms, compactness and connectedness.

MATH 5226. Mathematics of Financial Markets. (3) Cross-listed Course(s): MATH 4226. Prerequisite(s): MATH 3122 or STAT 3122 with grade of B or above, or permission of department. A preparatory course for actuarial exam IFM. Topics include: basic derivatives such as forwards and futures contracts, as well as vanilla, exchange, futures and exotic options; general properties of options; the binomial option pricing model; the Black-Scholes option pricing model; option greeks and risk management.

MATH 5228. Actuarial Science IIA. (3) Cross-listed Course(s): MATH 4228. Prerequisite(s): MATH 3122 or STAT 3122, and MATH 3228 with grades of B or above; or permission of department. An introduction to long-term insurance: Survival distribution: probability functions, life tables, force of mortality, mortality laws, life expectancy, select mortality; Insurance: continuous and discrete, moments, percentiles, recursive formulas; Annuities:

continuous and discrete, actuarial present and accumulated values, moments, percentiles, recursive formulas; Premiums: net premiums for continuous and discrete insurances, gross premiums, variance of future loss. This course is the first of two preparatory courses for Actuarial Exam LTAM.

MATH 5229. Actuarial Science IIB. (3) Cross-listed Course(s): MATH 4229. Prerequisite(s): MATH 5228 with grade of C or above; or permission of department. Long-Term Actuarial Mathematics. Reserves: net and gross premium reserves, variance of loss; Markov chains: discrete and continuous probabilities, applications to premiums and reserves; Multiple decrement models; Multiple lives: joint life, last survivor, and contingent probabilities; Estimating mortality rates; Pensions and Profit Measures. This course is the second of two preparatory courses for Actuarial Exam LTAM.

MATH 5691. Seminar. (1 to 6) Cross-listed Course(s): MATH 4691. Prerequisite(s): Permission of department. Individual or group investigation and exposition of selected topics in mathematics. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

MATH 5692. Seminar. (1 to 6) Cross-listed Course(s): MATH 4692. Prerequisite(s): Permission of department. A continuation of MATH 5691. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

MATH 6004. Topics in Analysis. (3) Cross-listed Course(s): EDCI 8004. Prerequisite(s): Permission of department. Topics in analysis selected so as to complement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.*

MATH 6008. Topics in Geometry and Topology. (3) Cross-listed Course(s): EDCI 8008. Prerequisite(s): Permission of department. Topics selected from Euclidean geometry, non-Euclidean geometry, projective geometry, differential geometry, point-set topology, algebraic topology. *May be repeated for credit with permission of department.*

MATH 6050. Topics in Mathematics. (3) Prerequisite(s): Permission of department. Topics chosen from applied mathematics applicable to other disciplines.

MATH 6101. Foundations of Mathematics. (3) Cross-listed Course(s): EDCI 8101. Prerequisite(s): Permission of department. Introduces the fundamentals of set theory and logic. Topics include: theorem proving, sets, functions, relations, and constructing number systems.

MATH 6102. Real Analysis for Secondary Mathematics Teachers. (3) Cross-listed Course(s): EDCI 8102. Prerequisite(s): MATH 6101 and permission of department. A theoretical understanding of the basics of real analysis. Topics include: limits and continuity, derivatives, integrals, and Taylor series.

MATH 6103. Computer Techniques and Numerical Methods. (3) Cross-listed Course(s): EDCI 8103. Prerequisite(s): Permission of department. Computer systems, programming, and the computer solution of numerical problems.

MATH 6105. Problem Solving in Discrete Mathematics. (3) Cross-listed Course(s): EDCI 8105. Prerequisite(s): Permission of department. Propositional and predicate calculus, counting techniques, partially ordered sets, lattices, graphs and trees.

MATH 6106. Modern Algebra for Secondary Mathematics Teachers. (3) Cross-listed Course(s): EDCI 8106. Prerequisite(s): MATH 3163 or its equivalent or permission of department. Topics chosen from group theory, rings and ideals, integral domains, fields and elementary Galois theory.

MATH 6107. Linear Algebra for Secondary Mathematics Teachers. (3) Cross-listed Course(s): EDCI 8107. Prerequisite(s): MATH 2164 or its equivalent or permission of department. Systems of linear equations, matrices, vector spaces, linear transformations, determinants, canonical forms of matrices, inner products.

MATH 6108. Probability and Statistics for Secondary Mathematics Teachers. (3) Cross-listed Course(s): STAT 6108. Prerequisite(s): Admission into the M.S. in Mathematics with Concentration in Mathematics Education program. Topics from probability and statistics appropriate for high school mathematics teachers. Topics in probability include: discrete and continuous random variables, probability distributions, sums and functions of random variables, the law of large numbers, and the central limit theorem. Topics in statistics include: sample mean and variance, estimating distributions, correlation, regression, and hypothesis testing.

MATH 6118. Non-Euclidean Geometry. (3) Cross-listed Course(s): EDCI 8118. Prerequisite(s): Permission of department. History of Euclid's Fifth Postulate and attempts to prove it; work of Gauss, Bolyai, Lobachevsky and others; systematic development of hyperbolic geometry; relative consistency of hyperbolic geometry; relative consistency of hyperbolic and Euclidean geometries.

MATH 6171. Advanced Applied Mathematics I. (3) Prerequisite(s): MATH 2241 and MATH 2171 with grades of C or above, or permission of department. Power series solutions of ordinary differential equations, vector calculus, line and surface integrals, partial differential equations and Fourier integrals.

MATH 6172. Advanced Applied Mathematics II. (3) Prerequisite(s): MATH 2241 and MATH 2171 with grades of C or above, or permission of department. Complex analysis; probability and statistics.

MATH 6201. Statistical Techniques in Finance. (3) This course reviews basic concepts and introduces more advanced techniques from Probability and Statistics which are commonly utilized in mathematical finance. Topics covered include random variables, distributions, conditional expectations, confidence intervals and hypothesis testing, simple and multiple regression, multivariate analysis including factor and canonical correlation analysis, and time series models including ARMA, ARIMA, ARCH, and GARCH.

MATH 6202. Derivatives II: Partial Differential Equations for Finance. (3) This course deals with those partial differential equations which are associated with financial derivatives based on factors such as equities and spot interest rates.

MATH 6203. Stochastic Calculus for Finance I. (3) Prerequisite(s): Admission to the graduate program and permission of Program Director. This course starts with the probability theory in discrete probability space, discrete-time stochastic processes, and derivatives pricing in the Binomial model. The second part covers probability theory in general probability space and continuous-time martingale and Markov processes. Topics include: the It'o integral, Black-Scholes model, It'o-Doeblin formula, Girsanovs theorem, and Martingale Representation theorem. Applications to pricing of exotic derivatives and American options are discussed.

MATH 6204. Numerical Methods for Financial Derivatives. (3) This course will introduce students to numerical and computational techniques for solving both European- and American-style financial derivatives. The approach will be the finite difference method and the basic theoretical concepts will be introduced. Final projects will involve implementing the techniques on computers. Some spectral and Monte Carlo methods will also be discussed.

MATH 6205. Financial Computing. (3) This lab-oriented course introduces the numerical methods needed for quantitative work in finance, focusing on derivative pricing and fixed income applications. Topics include: binomial and trinomial methods, Crank-Nicholson methods for various exotic options, treatment of discrete dividends, numerical methods for stochastic differential equations, random number generators, Monte-Carlo methods for European and American options. The computing course teaches theory and practice of numerical finance as well as the programming skills needed to build software systems in C/C++, Java, Javascript, and Mathematica/Matlab.

MATH 6206. Stochastic Calculus for Finance II. (3) Cross-listed Course(s): MATH 8206. Prerequisite(s): MATH 6203 or permission of department. The applications of stochastic calculus techniques to advanced financial modeling. Topics include: pricing of European, American, and fixed-income derivatives in the Black-Scholes and stochastic volatility models. The Jump-diffusion model is also introduced.

MATH 6609. Seminar in Mathematics. (1 to 3) Cross-listed Course(s): EDCI 8609. Prerequisite(s): Permission of department. A series of regularly scheduled meetings in which each student presents one or more topics selected by the instructor. *May be repeated for credit with permission of department.*

MATH 6690. Graduate Teaching Assistant Training. (1) Prerequisite(s): Permission of department. Discusses techniques used in the teaching of mathematics and statistics. This course is required as a condition of employment for new graduate teaching and instructional assistants in the department.

MATH 7028. Topics in Probability. (3) Prerequisite(s): MATH 7120 and MATH 7121, or permission of department. Topics of current interest in probability and advanced topics in probability. *May be repeated for credit with permission of department.*

MATH 7050. Topics in Mathematics. (2 to 3) Prerequisite(s): Permission of department. Topics chosen from such fields as algebra, topology, analysis, applied mathematics, differential geometry, mathematical physics, graph theory, probability, statistics. *May be repeated for credit with change of topic* and with the approval of the department.

MATH 7065. Topics in Applied Algebra and Algebraic Structures. (3) Prerequisite(s): Permission of department. Current topics in Applied Algebra and Algebraic Structure.

MATH 7070. Topics in Numerical Analysis. (3) Prerequisite(s): Permission of department. Topics of current interest in numerical analysis. *May be repeated for credit with permission of department.*

MATH 7071. Topics in Differential Equations. (3) Prerequisite(s): Permission of department. Topics of current interest in ODE, PDE, dynamical systems, inverse problems and related subjects. *May be repeated for credit with permission of department.*

MATH 7120. Probability Theory I. (3) Prerequisite(s): MATH 7143 and MATH/STAT 3122, or permission of department. Topics include: probability spaces, probability measures, sigma-algebras, characteristic functions, sequences of

random variables, law of large numbers, general forms of the Central Limit Theorem.

MATH 7121. Probability Theory II. (3) Prerequisite(s): MATH 7120 or permission of department. A continuation of MATH 7120.

MATH 7125. Stochastic Processes I. (3) Prerequisite(s): MATH 3122, MATH 7120, and MATH 7143, or permission of department. Basic ideas in the study of stochastic processes, selected from: discrete and continuous time Markov processes, stationary and renewal processes, applications to queuing theory, reliability theory, stochastic differential equations, time-series analysis, filtering and stochastic control theory.

MATH 7126. Stochastic Processes II. (3) Prerequisite(s): MATH 7125. A continuation of MATH 7125.

MATH 7141. Complex Analysis I. (3) Prerequisite(s): MATH 5143 or permission of department. Holomorphic functions, complex integration, residues, entire and meromorphic functions, conformal mapping, harmonic functions.

MATH 7142. Complex Analysis II. (3) Prerequisite(s): MATH 7141. A continuation of MATH 7141.

MATH 7143. Real Analysis I. (3) Prerequisite(s): MATH 5144 or permission of department. Lebesgue integration on the real line, Lp spaces, introduction to general measure and integration theory.

MATH 7144. Real Analysis II. (3) Cross-listed Course(s): MATH 8144. Prerequisite(s): MATH 7143 or permission of department. An introduction to linear functional analysis. Topics include: normed linear spaces, bounded linear operators, Banach spaces, duality for normed linear spaces, weak convergence, Hilbert spaces, and compact self-adjoint operators.

MATH 7147. Applied Functional Analysis. (3) Prerequisite(s): MATH 5144. Introduction to functional analysis and its applications to such areas as linear and nonlinear differential equations, integral equations, and control theory. Topics chosen from Banach spaces, operators, the Hahn-Banach, open mapping and closed graph theorems, Sobolev spaces, spectral theory, operators in Hilbert space.

MATH 7148. Functional Analysis. (3) Prerequisite(s): MATH 7144 or permission of department. Material selected from: spectral theory, spectral theory of differential operators, groups and semigroups of operators, nonlinear functional analysis, asymptotic analysis, integral equations, Fourier analysis, distributions, and Sobolev spaces.

MATH 7163. Modern Algebra I. (3) Prerequisite(s): MATH 4163 and MATH 4164, or permission of department. Topics include: Galois theory, commutative algebra, modules, ring theory, homological algebra.

MATH 7164. Modern Algebra II. (3) Prerequisite(s): MATH 7163. A continuation of MATH 7163.

MATH 7172. Partial Differential Equations. (3) Prerequisite(s): MATH 5174 and MATH 7144, or permission of department. Harmonic functions, mean-value theorem, maximum principle, Green's representation for the solution of the Dirichlet problem for Laplace's equation; Poisson's equations and the Poisson formula; statement and proof of the existence theorem for general second-order elliptic operators, generalized maximum principles; Sobolev spaces. Evolution equations involving elliptic operators, such as the heat or wave equations, may also be introduced.

MATH 7173. Evolution Equations. (3) Prerequisite(s): MATH 7144 and MATH 7172 or permission of department. Semigroups of operators and their generators, examples of semigroups. The heat equation, examples of elliptic operators that generate semigroups, Hille-Yosida theory, analytic semigroups; examples, fractional powers of operators.

MATH 7174. Linear and Nonlinear Waves. (3) Prerequisite(s): MATH 5124 and MATH 7144 or permission of department. Hyperbolic waves, characteristics, Riemann invariants, conservation laws, weak solutions, shock structure. Burger's equation, gas dynamics, dispersive waves, group velocity, water waves, nonlinear optics.

MATH 7175. Inverse Problems. (3) Prerequisite(s): MATH 5174 and MATH 7144, or permission of department. Ill-posed problems and numerical methods for them. Applications of inverse problems to real processes. One dimensional inverse problems. Multi-dimensional inverse problems: uniqueness and numerical methods. Inverse scattering problems.

MATH 7176. Advanced Numerical Analysis. (3) Prerequisite(s): MATH 2164, MATH 2171, and MATH 5176, or permission of department. A selection of topics from such areas as iterative methods of solving linear and nonlinear systems of equations, approximation theory, splines, and finite element methods for partial differential equations.

MATH 7177. Applied Optimal Control. (3) Prerequisite(s): MATH 5143 or permission of department. Examples of control systems and optimization problems, optimal control of discrete-time systems, solutions of the general discrete-time optimization problem, optimal control of

continuous-time systems, the calculus of variations, solution of the general continuous optimization problem, applications of the Pontryagin Maximum Principle, Dynamic programming, and Bang-bang control. Controllability and differential games may also be introduced.

MATH 7178. Computational Methods for Fluid Dynamics. (3) Prerequisite(s): MATH 2242, MATH 2171, MATH 5174, and MATH 5176, or permission of department. Topics on various numerical techniques for the solution of incompressible and compressible flows. Finite difference, finite element and spectral methods, and shock capturing and fitting methods. Multi-grid method and acceleration techniques.

MATH 7179. Advanced Finite Difference Methods. (3) Prerequisite(s): Permission of department. Accuracy analysis and design of high order schemes, stability theory of schemes with variable coefficients, stability theory of schemes for initial-boundary value problems, convergence theory for nonlinear cases.

MATH 7180. Advanced Numerical Methods in Scientific Computing. (3) Prerequisite(s): MATH 5172 and MATH 5176, or permission of the department. Introduces advanced numerical methods in scientific computing. Topics include: Particle-Mesh Ewald and the Fast multipole methods, boundary element methods, absorbing and perfectly matched layered boundary conditions, Yee's finite difference and discontinuous Galerkin methods, surface integral equation methods, Nedelec edge elements for Maxwell equations, Bloch theory and periodic structures and photonics, Boltzmann and Wigner kinetic methods, high resolution Godunov methods and WENO methods for hydrodynamic equations, particle-in-cell and constrained transport methods for magnetohydrodynamics.

MATH 7181. Topology I. (3) Prerequisite(s): Permission of department. Topological spaces, continuous functions, connectedness, compactness, and metrizability, and further topics from point-set, geometric or algebraic topology.

MATH 7182. Topology II. (3) Prerequisite(s): MATH 7181. A continuation of MATH 7181.

MATH 7184. Differential Geometry I. (3) Prerequisite(s): Permission of department. Manifolds, differential structures, tangent bundles, embeddings, immersions, inverse function theorem, Morse-Sard theorem, transversality, Borsuk-Ulam theorem, vector bundles, Euler characteristics, Morse theory, Stokes theorem, Gauss-Bonnet theorem, Whitney embedding theorem.

MATH 7185. Differential Geometry II. (3) Prerequisite(s): Permission of department. Differentiable manifolds, differential forms, critical points, local and global theory of curves, local and global theory of surfaces, connections, geodesics, curvature, spaces of constant curvature, Lie groups and Lie algebras.

MATH 7273. Advanced Finite Element Analysis. (3) Prerequisite(s): MATH 5172 and MATH 5174, or permission of department. Selection of topics from such areas of finite element analysis as convergence theorems (Ciarlet), hierarchical basis functions, the h-p method, adaptive grid techniques and solution methods for nonlinear equations.

MATH 7275. Dynamical Systems I. (3) Prerequisite(s): MATH 5143 and MATH 5173, or permission of department. Cycles and separatrix cycles, Poincaré first-return map: diffeomorphisms, Poincaré-Bendixson Theory, flows on the two-torus; structural stability, genericity, Peixoto's theorem; singularities of planar systems. Degenerate singularities, Hopf bifurcation, saddle-node bifurcation, center bifurcation.

MATH 7276. Dynamical Systems II. (3) Prerequisite(s): MATH 7275 or permission of department. Method of averaging, Melnikov functions, hyperbolic structure, symbolic dynamics, homoclinic and heteroclinic orbits, global bifurcations, infinite dimensional dynamical systems, inertial manifolds, Lyapunov exponents and dimension of attractors, codimension-two bifurcations, Duffing's equation, Lorenz equations, finite dimensional systems of dimension at least three.

MATH 7490. Industrial Internship. (0 to 6) Prerequisite(s): completion of 6 credit hours of coursework in MATH/STAT/OPRS graduate courses and permission of department. Full- or part-time academic year or summer internship in mathematics and/or statistics complementary to the student's major course of study and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by the department's Graduate Program Director. Requires a mid-term report and final report to be graded by the supervising faculty. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit up to 6 credit hours. Credit hours gained from the internship may not be counted toward the courses leading to advancement to candidacy.*

MATH 7891. Independent Study in Mathematics. (1 to 3) Prerequisite(s): Permission of department. Faculty-directed independent study of topics not provided by other course offerings and/or to examine, extend, and enrich extant knowledge in mathematics through supervised individual study. *May be repeated for credit with change of topic.*

MATH 7892. Directed Project in Mathematics. (1 to 3) Prerequisite(s): Permission of department. The directed independent project may be original work, work of an expository nature, or the mathematical formulation and solution of a particular problem of mathematical significance. The project may also involve a specific application of techniques identified in the literature or studied in other courses. The project must be defended in an oral presentation. *May be repeated for credit up to 6 credit hours.*

MATH 7994. Master's Thesis. Research. (3) Prerequisite(s): Permission of department. Subject to the approval of the department Graduate Committee, the thesis may be original work, work of an expository nature, or the mathematical formulation and solution of a particular industrial or business problem suggested by the career interests of the student. The thesis must be defended in an oral presentation. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 6 credit hours.*

MATH 8028. Topics in Probability. (3) Prerequisite(s): MATH 8120 and MATH 8121, or permission of department. Topics of current interest in probability and advanced topics in probability. *May be repeated for credit with permission of department.*

MATH 8050. Topics in Mathematics. (2 to 3) Prerequisite(s): Permission of department. Topics chosen from such fields as algebra, topology, analysis, applied mathematics, differential geometry, mathematical physics, graph theory, probability, statistics. *May be repeated for credit with change of topic and with the approval of the department.*

MATH 8065. Topics in Applied Algebra and Algebraic Structures. (3) Prerequisite(s): Permission of department. Current topics in Applied Algebra and Algebraic Structure.

MATH 8070. Topics in Numerical Analysis. (3) Prerequisite(s): Permission of department. Topics of current interest in numerical analysis. *May be repeated for credit with permission of department.*

MATH 8071. Topics in Differential Equations. (3) Prerequisite(s): Permission of department. Topics of current interest in ODE, PDE, dynamical systems, inverse problems and related subjects. *May be repeated for credit with permission of department.*

MATH 8120. Probability Theory I. (3) Prerequisite(s): MATH 8143 and MATH/STAT 3122, or permission of department. Topics include: probability spaces, probability measures, sigma-algebras, characteristic functions, sequences of random variables, law of large numbers, general forms of the Central Limit Theorem.

MATH 8121. Probability Theory II. (3) Prerequisite(s): MATH 8120 or permission of department. A continuation of MATH 8120.

MATH 8125. Stochastic Processes I. (3) Prerequisite(s): MATH 3122, MATH 8120, and MATH 8143, or permission of department. Basic ideas in the study of stochastic processes, selected from: discrete and continuous time Markov processes, stationary and renewal processes, applications to queuing theory, reliability theory, stochastic differential equations, time-series analysis, filtering and stochastic control theory.

MATH 8126. Stochastic Processes II. (3) Prerequisite(s): MATH 8125. A continuation of MATH 8125.

MATH 8141. Complex Analysis I. (3) Prerequisite(s): MATH 5143 or permission of department. Holomorphic functions, complex integration, residues, entire and meromorphic functions, conformal mapping, harmonic functions.

MATH 8142. Complex Analysis II. (3) Prerequisite(s): MATH 8141. A continuation of MATH 8141.

MATH 8143. Real Analysis I. (3) Prerequisite(s): MATH 5144 or permission of department. Lebesgue integration on the real line, Lp spaces, introduction to general measure and integration theory.

MATH 8144. Real Analysis II. (3) Cross-listed Course(s): MATH 7144. Prerequisite(s): MATH 7143, MATH 8143, or permission of department. An introduction to linear functional analysis. Topics include: normed linear spaces, bounded linear operators, Banach spaces, duality for normed linear spaces, weak convergence, Hilbert spaces, and compact self-adjoint operators.

MATH 8147. Applied Functional Analysis. (3) Prerequisite(s): MATH 5144. Introduction to functional analysis and its applications to such areas as linear and nonlinear differential equations, integral equations, and control theory. Topics chosen from Banach spaces, operators, the Hahn-Banach, open mapping and closed graph theorems, Sobolev spaces, spectral theory, operators in Hilbert space.

MATH 8148. Functional Analysis. (3) Prerequisite(s): MATH 8144 or permission of department. Material selected from: spectral theory, spectral theory of differential operators, groups and semigroups of operators, nonlinear functional analysis, asymptotic analysis, integral equations, Fourier analysis, distributions, and Sobolev spaces.

MATH 8163. Modern Algebra I. (3) Prerequisite(s): MATH 4163 and MATH 4164 or permission of department. Topics selected from Galois theory, commutative algebra, modules, ring theory, homological algebra.

MATH 8164. Modern Algebra II. (3) Prerequisite(s): MATH 8163. A continuation of MATH 8163.

MATH 8172. Partial Differential Equations. (3) Prerequisite(s): MATH 5174 and MATH 8144, or permission of department. Harmonic functions, mean-value theorem, maximum principle, Green's representation for the solution of the Dirichlet problem for Laplace's equation; Poisson's equations and the Poisson formula; statement and proof of the existence theorem for general second-order elliptic operators, generalized maximum principles; Sobolev spaces. Evolution equations involving elliptic operators, such as the heat or wave equations, may also be introduced.

MATH 8173. Evolution Equations. (3) Prerequisite(s): MATH 8144 and MATH 8172, or permission of department. Semigroups of operators and their generators, examples of semigroups. The heat equation, examples of elliptic operators that generate semigroups, Hille-Yosida theory, analytic semigroups; examples, fractional powers of operators.

MATH 8174. Linear and Nonlinear Waves. (3) Prerequisite(s): MATH 5144 and MATH 8144, or permission of department. Hyperbolic waves, characteristics, Riemann invariants, conservation laws, weak solutions, shock structure. Burger's equation, gas dynamics, dispersive waves, group velocity, water waves, nonlinear optics.

MATH 8175. Inverse Problems. (3) Prerequisite(s): MATH 5174 and MATH 8144, or permission of department. Ill-posed problems and numerical methods for them. Applications of inverse problems to real processes. One dimensional inverse problems. Multi-dimensional inverse problems: uniqueness and numerical methods. Inverse scattering problems.

MATH 8176. Advanced Numerical Analysis. (3) Prerequisite(s): MATH 2164, MATH 2171, and MATH 5176, or permission of department. A selection of topics from such areas as iterative methods of solving linear and nonlinear systems of equations, approximation theory, splines, and finite element methods for partial differential equations.

MATH 8177. Applied Optimal Control. (3) Prerequisite(s): MATH 5143 or permission of department. Examples of control systems and optimization problems, optimal control of discrete-time systems, solutions of the general discrete-time optimization problem, optimal control of continuous-time systems, the calculus of variations, solution of the general continuous optimization problem, applications of the Pontryagin Maximum Principle, Dynamic programming, and Bang-bang control. Controllability and differential games may also be introduced.

MATH 8178. Computational Methods for Fluid Dynamics. (3) Prerequisite(s): MATH 2242, MATH 2171, MATH 5174, and MATH 5176, or permission of department. Topics on various numerical techniques for the solution of incompressible and compressible flows. Finite difference, finite element and spectral methods, and shock capturing and fitting methods. Multi-grid method and acceleration techniques.

MATH 8180. Advanced Numerical Methods in Scientific Computing. (3) Prerequisite(s): MATH 5172 and MATH 5176, or permission of the department. Introduces advanced numerical methods in scientific computing. Topics include: Particle-Mesh Ewald and the Fast multipole methods, boundary element methods, absorbing and perfectly matched layered boundary conditions, Yee's finite difference and discontinuous Galerkin methods, surface integral equation methods, Nedelec edge elements for Maxwell equations, Bloch theory and periodic structures and photonics, Boltzmann and Wigner kinetic methods, high resolution Godunov methods and WENO methods for hydrodynamic equations, particle-in-cell and constrained transport methods for magnetohydrodynamics.

MATH 8181. Topology I. (3) Prerequisite(s): Permission of department. Topological spaces, continuous functions, connectedness, compactness, and metrizability, and further topics from point-set, geometric or algebraic topology.

MATH 8182. Topology II. (3) Prerequisite(s): MATH 8181. A continuation of MATH 8181.

MATH 8184. Differential Geometry I. (3) Prerequisite(s): Permission of department. Manifolds, differential structures, tangent bundles, embeddings, immersions, inverse function theorem, Morse-Sard theorem, transversality, Borsuk-Ulam theorem, vector bundles, Euler characteristics, Morse theory, Stokes theorem, Gauss-Bonnet theorem, Whitney embedding theorem.

MATH 8185. Differential Geometry II. (3) Prerequisite(s): Permission of department. Differentiable manifolds, differential forms, critical points, local and global theory of curves, local and global theory of surfaces, connections, geodesics, curvature, spaces of constant curvature, Lie groups and Lie algebras.

MATH 8202. Partial Differential Equations for Finance. (3) Cross-listed Course(s): MATH 6202. This course deals with those partial differential equations which are associated with financial derivatives based on factors such as equities and spot interest rates.

MATH 8203. Stochastic Calculus for Finance. (3) Cross-listed Course(s): MATH 6203. An introduction to those aspects of partial differential equations and diffusion processes most relevant to finance, Random walk and first-step analysis, Markov property, martingales and semi-martingales, Brownian motion. Stochastic differential equations: Ito's lemma, backward and forward Kolmogorov equations, the Feynman-Kac formula, stopping times, Hull and White Models, Cox-Ingersoll-Ross Model. Applications to finance including portfolio optimization and option pricing.

MATH 8204. Numerical Methods for Financial Derivatives. (3) Cross-listed Course(s): MATH 6204. Introduction to numerical and computational techniques for solving both European- and American-style financial derivatives. The approach is the finite difference method and the basic theoretical concepts are introduced. Final projects involve implementing the techniques on computers. Some spectral and Monte Carlo methods are also be discussed.

MATH 8206. Stochastic Calculus for Finance II. (3) Cross-listed Course(s): MATH 6206. Prerequisite(s): MATH 8203 or permission of department. The applications of stochastic calculus techniques to advanced financial modeling. Topics include: pricing of European, American, and fixed-income derivatives in the Black-Scholes and stochastic volatility models. The Jump-diffusion model is also introduced.

MATH 8273. Advanced Finite Element Analysis. (3) Prerequisite(s): MATH 5172 and MATH 5174, or permission of department. Selection of topics from such areas of finite element analysis as convergence theorems (Ciarlet), hierarchical basis functions, the h-p method, adaptive grid techniques and solution methods for nonlinear equations.

MATH 8275. Dynamical Systems I. (3) Prerequisite(s): MATH 5143 and MATH 5173, or permission of department. Cycles and separatrix cycles, Poincaré first-return map: diffeomorphisms, Poincaré-Bendixson Theory, flows on the two-torus; structural stability, genericity, Peixoto's theorem; singularities of planar systems. Degenerate singularities, Hopf bifurcation, saddle-node bifurcation, center bifurcation.

MATH 8276. Dynamical Systems II. (3) Prerequisite(s): MATH 8275 or permission of department. Method of averaging, Melnikov functions, hyperbolic structure, symbolic dynamics, homoclinic and heteroclinic orbits, global bifurcations, infinite dimensional dynamical systems, inertial manifolds, Lyapunov exponents and dimension of attractors, codimension-two bifurcations, Duffing's equation, Lorenz equations, finite dimensional systems of dimension at least three.

MATH 8490. Industrial Internship. (0 to 6) Prerequisite(s): completion of 6 credit hours of coursework in MATH/STAT/OPRS graduate courses and permission of department. Full- or part-time academic year or summer internship in mathematics and/or statistics complementary to the student's major course of study and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by the department's Graduate Program Director. Requires a mid-term report and final report to be graded by the supervising faculty. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit up to 6 credit hours. Credit hours gained from the internship may not be counted toward the courses leading to advancement to candidacy.*

MATH 8891. Independent Study in Mathematics. (1 to 3) Prerequisite(s): Permission of department. Faculty-directed independent study of topics not provided by other course offerings and/or to examine, extend, and enrich extant knowledge in mathematics through supervised individual study. *May be repeated for credit with change of topic.*

MATH 8892. Directed Project in Mathematics. (1 to 3) Prerequisite(s): Permission of department. The directed independent project may be original work, work of an expository nature, or the mathematical formulation and solution of a particular problem of mathematical significance. The project may also involve a specific application of techniques identified in the literature or studied in other courses. The project must be defended in an oral presentation. *May be repeated for credit up to 9 credit hours.*

MATH 8994. Doctoral Research and Reading. (0 to 9) Prerequisite(s): Permission of department. Investigation of a topic in mathematics culminating in a research paper. *May be repeated for credit.*

MATH 8999. Doctoral Dissertation Research. (1) Prerequisite(s): Advancement to Candidacy. Individual investigation and research leading to the preparation of a doctoral dissertation. *May be repeated for credit.*

Master of Business Administration (MBAD)

MBAD 5110. Foundation of Economics. (3) Prerequisite(s): Enrollment in MBA or Graduate Certificate program. Focuses on topics related to the scope and methodology

of economics as a social science, the analysis of markets, the development of market structure, the characteristics of market failure, problems of economic concentration, the measurement of national income, the theory of national income determination, money and banking, monetary and fiscal policy, international economics and the theory of income distribution.

MBAD 5121. Business Information Systems. (3) Prerequisite(s): Enrollment in MBA or Graduate Certificate program, and basic computer knowledge and skills. Examination of how information systems are developed and used in organizations, how information resources are managed, and the potential strategic and competitive impact information systems have in domestic and global business environments.

MBAD 5131. Fundamentals of Financial Accounting and Financial Management. (3) Prerequisite(s): Enrollment in MBA or Graduate Certificate program. Accelerated and in-depth study of conceptual foundations and applications of financial accounting and financial management with emphasis on building accounting and finance information bases for external decision making. (Accounting and finance preparation to enter the MBA. May not be taken for credit toward any undergraduate degree within the Belk College of Business or used as equivalent credit for ACCT 2121-2122).

MBAD 5141. Business Statistics and Quantitative Analysis. (3) Prerequisite(s): Enrollment in MBA or Graduate Certificate program. Designed to bring MBA students up to an acceptable level of analytical capability in the areas of probability theory, business statistics, basic linear mathematics (algebra and matrix algebra) and basic differential and integral calculus.

MBAD 5158. Student Managed Investment Fund I. (3) Cross-listed Course(s): FINN 5158. Prerequisite(s): MBAD 5159, FINN 3120 or MBAD 6152, FINN 3222 or FINN/MBAD 6153, and permission of instructor. Management of an actual portfolio consisting of a portion of the University's Endowment Fund.

MBAD 5159. Student Managed Investment Fund II. (3) Cross-listed Course(s): FINN 5159. Prerequisite(s): MBAD 5158, FINN 3120 or MBAD 6152, FINN 3222 or FINN/MBAD 6153, and permission of instructor. Management of an actual portfolio consisting of a portion of the University's Endowment Fund.

MBAD 5191. Legal Environment in Business. (1) Prerequisite(s): enrollment in MBA program. Legal environment in which business operates today; Legal, social, and ethical considerations of managers within the framework of federal and state regulatory laws; role and function of federal regulatory agencies and their impact on business activities.

MBAD 5300. Entrepreneurial Decisions. (3) Cross-listed Course(s): MGMT 4300. Examines the important decisions that entrepreneurs make in forming new ventures, from founding a venture as an individual versus a team, to growth: how much and how fast, to self-financing versus debt versus equity, to rules: playing by them versus setting them.

MBAD 6028. Topics in Business Information Systems. (3) Prerequisite(s): MBAD 5121 or equivalent. Selected topics in information systems. Topics include: information resource management, database management systems, management support systems, information systems in the financial and banking industry, information systems in manufacturing, information systems in health care, and EDP auditing. *May be repeated for credit with change of topic and permission of MBA Program Director.*

MBAD 6058. Special Topics in Financial Services. (3) Prerequisite(s): MBAD 6152. Each year, the subject matter of this course deals with a different specialized and contemporary topic of interest to students who are preparing for management careers in the financial services industry. Topics are chosen and covered in a way that builds on and supplements the topics covered in other courses in the Financial Institutions/Commercial Banking concentration. Emphasis is placed on the managerial implications of the subject matter as well as the impact on the financial system. *May be repeated for credit with change of topic one time.*

MBAD 6101. Ethical Leadership. (3) Prerequisite(s): Enrollment in the MBA Program. Examination of the roles of organizational values, culture, leadership, and governance in the avoidance of misconduct and in the development and maintenance of ethical organizations. Emphasis is placed on individual ethical decision-making challenges in organizations and on the development of ethical leadership skills.

MBAD 6111. Macroeconomics and Business Forecasting. (3) Prerequisite(s): MBAD 5110 and MBAD 5141. Advanced studies of the interrelations of markets in national and international economies; mechanisms of monetary policy and interest rate effects, foreign exchange rates and inflation; relations between national saving, fiscal policy, foreign debt and investment; short-run and long-run effects of economic policy; tax policy, government spending and economic growth; types of economic forecasts; value and limits of forecasts.

MBAD 6112. The Economics of Business Decisions. (3) Prerequisite(s): MBAD 5110 and MBAD 5141, or equivalents. Economic concepts in the decision-making process.

Topics include: scarcity; marginal analysis and tools of optimization; demand and supply analysis and market structure; economic efficiency; regression analysis; risk analysis and game theory; and international issues.

MBAD 6122. Decision Modeling and Analysis. (3) Cross-listed Course(s): DSBA 6122. Prerequisite(s): MBAD 5141 or equivalent. An analytical approach to the management process. Generalized models for decision making with major emphasis on application of the scientific method to management problems.

MBAD 6131. Financial and Managerial Accounting for MBAs. (3) Prerequisite(s): MBAD 5131 or equivalent. Analyzing financial statements and using accounting information for strategic, tactical, and operating decisions with a focus on strategic cost management. Emphasis is on using cost and other management accounting information in making sound decisions, its effect on managerial behavior, and its use in formulating and implementing strategy, and issues of design and operation of management control systems including the intended and unintended consequences of performance measurement.

MBAD 6141. Operations Management. (3) Prerequisite(s): MBAD 5141 or equivalent. Design, operation, and control of service and manufacturing systems. Emphasis on using analytical tools for problem solving in process analysis and re-engineering, work-force management, material and inventory management, aggregate planning, total quality management, and others.

MBAD 6151. Financial Institutions and Markets. (3) Cross-listed Course(s): FINN 6151. Prerequisite(s): MBAD 6152. Major financial institutions, particularly commercial banks, and their role in the intermediation process and as suppliers of funds to the money and capital markets. Comparative financial policies of these institutions are examined in the context of their legal and market environment.

MBAD 6152. Financial Management. (3) Cross-listed Course(s): FINN 6152 and MSRE 6152. Prerequisite(s): MBAD 6112 and MBAD 6131. Theory and practice of corporate finance including asset management, cost of capital and capital budgeting, optimization problems and socio-economic aspects of financial management. Computer technology may be employed when applicable.

MBAD 6153. Investment Management. (3) Cross-listed Course(s): FINN 6153. Prerequisite(s): MBAD 6152. Theory and practice of investment decisions of individuals and fund managers. Topics include: the status of capital market theory, the efficient market hypothesis literature, and a portfolio performance measurement. Standard institutional and investment analysis topics, futures and options markets, and international investment topics are covered.

MBAD 6154. Applied Business Finance. (3) Cross-listed Course(s): FINN 6154. Prerequisite(s): MBAD 6152. Examination of business finance topics which typically confront the firm's primary finance functional areas (CFO, Treasurer, Controller). The purpose is to develop advanced analytical skills in those topic areas. The following topics form the basis of the course: lease vs buy (borrow); leveraged buy-outs: merger analysis (emphasis on valuation); international operations of American firms (capital budgeting and cost of capital); capital structure; risk management. Such additional topics as working capital management; risk management; and relevant current topics will be included as time permits.

MBAD 6155. Multinational Financial Management. (3) Cross-listed Course(s): FINN 6155. Prerequisite(s): MBAD 6152. Financial management of the multinational firm including management of foreign exchange risk and political risk, and the control and evaluation of financial policies of multinational firms.

MBAD 6156. Commercial Bank Management. (3) Cross-listed Course(s): FINN 6156. Prerequisite(s): MBAD 6152. Techniques for the management of commercial banks. Topics of study include industry structure, administrative organization, management of assets, liabilities, and capital, and financial analysis of the banking firm.

MBAD 6157. Advanced Corporate Finance. (3) Cross-listed Course(s): FINN 6157. Prerequisite(s): MBAD 6152. Theories of modern corporate finance, including theory of efficient capital markets; uncertainty and the theory of choice; market equilibrium asset pricing models (capital asset pricing model, arbitrage pricing theory, Black-Scholes); theories of capital structure and the cost of capital; dividend policy; and leasing.

MBAD 6158. Real Estate Finance and Investment. (3) Cross-listed Course(s): MSRE 6158. Prerequisite(s): MBAD 6152. Focuses on the techniques used to analyze, finance and structure real estate transactions. Topics include: an overview of the real estate space and capital markets; the techniques of financial analysis; project ownership, taxation and financial structure; determining the financial feasibility of real estate development; and corporate real estate strategies.

MBAD 6159. Real Estate Development. (3) Cross-listed Course(s): GEOG 6103 and MSRE 6159. An introduction to the real estate development process. Identification and evaluation of the critical assumptions and issues related to market and site feasibility, financial feasibility, planning, acquisition, construction, and operation of economically viable commercial real estate projects. Students work in

groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

MBAD 6160. Real Estate Capital Markets. (3) Cross-listed Course(s): MSRE 6160. Prerequisite(s): MBAD 6152. The techniques used to analyze, finance and structure real estate transactions, and emphasizes the role of the capital markets in facilitating development and investment in commercial real estate. Topics include: real estate in an investment portfolio; valuation and investment analysis for direct (private) real estate equity investment including coverage of valuation using real option methodology; primary and secondary commercial mortgage markets (CMBS); and, analysis of publicly traded equity real estate investment trusts (REITs).

MBAD 6161. Human Behavior in Organizations. (3) Behavioral knowledge and skills essential to becoming an effective manager/leader including behavior and motivation in an environment of complexity and rapid change and ethical implications of actions and their effects on demographically diverse and increasingly international work force.

MBAD 6162. Leadership in Organizations. (3) Prerequisite(s): MBAD 6161. Continuation of MBAD 6161. Examines performance determinants and appraisal, design of complex organizations, team building, organizational change, career development and conflict management.

MBAD 6163. Managing People for Competitive Advantage. (3) Prerequisite(s): MBAD 6161. An examination of the current critical issues and strategic questions associated with managing employees. Case material, readings, and audiovisual material are used to stimulate discussion of the most important and strategic questions to be tackled by general managers today and in the future in the relationship between management and workers.

MBAD 6164. Executive Communication. (3) Intensive study of communication in organizations from middle and upper management perspectives with special attention to corporate communication, media relations, technologically mediated communication, crisis communication and public affairs. Case studies, readings, and project assignments are used in a variety of business situations.

MBAD 6165. Negotiation and Conflict Management. (3) Negotiation is the art and science of securing agreement between two or more independent parties. Conflict management involves resolving situations where the interests of two or more parties differ. Involves developing a repertoire of skills and techniques for negotiation and conflict management to develop a systematic and positive approach for negotiating with multiple stakeholders. Case studies, readings, and simulations are used.

MBAD 6166. Ethics and Global Capitalism. (3) Prerequisite(s): Must be a Belk College of Business graduate student or permission of the MBA Program Director. Study of ethical arguments supporting and critical of capitalist economic and social systems in relation to business strategy and public policy. Topics include: property rights, justice, desert, equality, and sustainable capitalism.

MBAD 6191. Entrepreneurial Strategy. (3) Prerequisite(s): MBAD 6131, MBAD 6152, MBAD 6270, or permission of the MBA Program Director. An examination of entrepreneurship and entrepreneurs. Focus on planning the start-up of a fast-growth enterprise with the aim of rewarding the founders and initial investors with significant capital gains. Extensive use of case studies provide a background of classroom activities to assist students in the preparation of a detailed plan for the hypothetical start-up of a fast-growth firm.

MBAD 6192. Business Ethics and Corporate Responsibility. (3) Analysis of ethical issues that arise in contemporary business practice, both domestically and globally. Topics may include ethical issues concerning labor practices, marketing, financial services, environmental practices, human rights, and emerging technologies. Students will be taught to recognize, analyze, and address ethical challenges as they arise in their careers. Consideration will also be given to public policies and global ethics codes that inform business decision making. Case studies are used.

MBAD 6193. Global Business Environment. (3) Prerequisite(s): MBAD 6152, MBAD 6270, or permission of the MBA Program Director. An overview of international business management. Specifically, the functional areas of business are covered to provide an international perspective.

MBAD 6194. Global Strategic Management. (3) Prerequisite(s): All courses in the primary and intermediate block of the Functional Component or permission of the Director of the MBA program. Examination of the need to integrate the functional activities of the firm in planning corporate objectives and achieving operating results. Emphasis on ability to identify issues and problems of the firm as a whole, to explore alternatives and to make decisions which recognize the interrelationships of the functional specialties within the total organization. Application and integration of knowledge and skills of analysis developed in the preceding courses of the MBA program.

MBAD 6196. Strategic Planning. (3) Prerequisite(s): Permission of instructor. Strategic planning within a rapidly changing environment including changing industry conditions as well as technological, social, political and economic changes. Examination of strategic planning techniques being developed by researchers and by corporate practitioners.

MBAD 6197. International Business Management. (3) Prerequisite(s): MBAD 6270 and one of the following: MBAD 5300, MBAD 6191, MBAD 6302, MBAD 6304, MBAD 6305, MBAD 6306, or MBAD 6309; or permission of instructor. Experiential learning for early-to mid-career management professionals that have some prior exposure to international business transactions but hope to gain current knowledge and hands-on experiences into a more responsible position in international business development. The focus of learning is on the changing and diverse international business environment, and the discovery and strategic management of opportunities and threats.

MBAD 6198. Professional Applications. (3) Prerequisite(s): Completion of the Functional Component. Team-taught, multidisciplinary course based on (1) structured, written cases and (2) contemporary management problems/issues presented in a non-structured, non-case format. Requires formal written position papers evaluating current business problems which are presented and defended before an audience of peers, faculty members, and business leaders.

MBAD 6201. Business Intelligence and Analytics. (3) Prerequisite(s): MBAD 5121 or equivalent. An overview of the business approach to identifying, modeling, retrieving, sharing, and evaluating an enterprise's data and knowledge assets. Focuses on the understanding of data and knowledge management, data warehousing, data mining (including rule-based systems, decision trees, neural networks, etc.), and other business intelligence concepts. Covers the organizational, technological and management perspectives.

MBAD 6202. Digitization of Business Processes. (3) Examination of key issues involved in digitization of business processes. Topics include: digitization strategies, systems analysis and design, data management, evaluation of IT investments, and management of emerging technologies.

MBAD 6203. Information Systems Economics, Strategy and Policy. (3) Prerequisite(s): MBAD 5121 or equivalent. Examines a collection of topics that deal with the strategic use of information systems. Topics include: Business Value of IS, Network Economics, use of IS for competitive advantage, IS Planning and policy setting, IS evaluation selection and sourcing.

MBAD 6204. Management of Cybersecurity and Privacy. (3) Prerequisite(s): MBAD 5121 or equivalent. Managing key cybersecurity and privacy challenges faced by IT managers. Examines computer network concepts, threat environments, cybersecurity tools, methods, and controls for risk management and the development of cybersecurity management and policy. Various cybersecurity and privacy standards and evaluation criteria are also covered.

MBAD 6207. Business Project Management. (3) Cross-listed Course(s): DSBA 6207. Project management is widely used in a variety of business environments to manage complex, non-routine endeavors. Examples of projects include consulting and process improvement projects, advertising projects, and technology projects. This course focuses on tools, techniques, and skills for business project management, with attention to both the quantitative and the qualitative aspects of project management. Topics include: project evaluation, estimation, monitoring, risk management, audit, managing global projects, outsourcing, and project portfolio management. Students also gain experience using Project Management Software.

MBAD 6208. Supply Chain Management. (3) Cross-listed Course(s): DSBA 6208. Supply chain management is concerned with all of the activities performed from the initial raw materials to the ultimate consumption of the finished product. From a broad perspective, the course is designed to examine the major aspects of the supply chain: the product flows; the information flows; and the relationships among supply chain participants. The course content is interdisciplinary in nature and will cover a variety of topics such as supply chain information technologies, supply chain design, strategic alliances between supply chain participants and supply chain initiatives.

MBAD 6209. Management of Service Operations. (3) Focuses on the challenges of managing service operations. The major topics covered are those critical to achieving operational excellence, including the design and delivery of services, service productivity, revenue management, risk management, customer contact management, service quality and customer retention, capacity management, and demand management. The course uses cases, readings, lectures and problem-solving tools to provide students with an understanding of these topics.

MBAD 6211. Advanced Business Analytics. (3) Cross-listed Course(s): DSBA 6211. Prerequisite(s): MBAD 6201, ITCS 6162, or permission of department. An in-depth study of applications of data analytics techniques to discover non-trivial relationships that are understandable, useful, and actionable to decision makers. A case approach is used

to emphasize hands-on learning and real-world deployment of business analytics.

MBAD 6212. Enterprise Systems. (3) Cross-listed Course(s): DSBA 6212. Prerequisite(s): Permission of DSBA Program Director. An overview of Enterprise Resource Planning (ERP). Using business cases and hands-on training with ERP tools, students learn how ERP systems support an organization's core business processes in achieving its strategic and operational goals. The role of ERP systems in business analytics and intelligence, the configuration of ERP systems, and the methods of evaluation, selection and implementation of ERP systems are also covered.

MBAD 6213. Applied Healthcare Business Analytics. (3) Cross-listed Course(s): DSBA 6213 and HCIP 6213. Pre-requisites: Demonstrated proficiency with Microsoft Excel; and either HCIP 5123, STAT 5123, HADM 6108 (for students with background in healthcare administration), HCIP 6108 (for students with background in healthcare informatics), or equivalent. Focuses on applying business analytics within the healthcare setting. Students learn analytical tools used to synthesize big data into meaningful management information that is used in making key business decisions that impact the delivery of healthcare services. Case studies are utilized to prepare students for delivering boardroom level presentations of their findings.

MBAD 6238. Real Estate and Urban Economics. (3) Prerequisite(s): ECON 2102. Cross-listed Course(s): ECON 6238 and MSRE 6238. Focuses on the fundamental economic forces that create urban areas, with a special emphasis on land markets. Integrates economic theory to better understand the market forces that impact applied real estate development projects. Topics include: urban growth and development; land valuation; the modelling and estimation of agglomeration economies; the costs of cities and their internal structure with emphasis on land use regulations and transportation; amenities and the local supply of labor; the sizes and functions of cities; affordable housing; and local public finance.

MBAD 6258. Site Feasibility Analysis. (3) Cross-listed Course(s): GEOG 6305 and MSRE 6258. Prerequisite(s): Permission of instructor. Examination of factors affecting the feasibility of land parcels for commercial and residential development with emphasis on the physical evaluation of a given site, the market support for its intended use, and the financial support for the proposed development.

MBAD 6259. Applied Real Estate Development. (3) Cross-listed Course(s): GEOG 6105 and MSRE 6259. Prerequisite(s): MBAD 6159, MSRE 6159, or GEOG 6103. The application of the processes involved in real estate development. Students will work in groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

MBAD 6270. Marketing Management. (3) A managerial approach to strategic marketing decision-making. Topics include: market segmentation, product strategy, pricing strategy, promotion strategy, distribution strategy, demand analysis, future market projection and global marketing. Case studies, readings, and simulations are used.

MBAD 6271. Consumer Behavior and Strategy. (3) Prerequisite(s): MBAD 6270. The consumer is the central focus of all business activity. Designed to help understand consumption-related behaviors and develop marketing strategies to influence those behaviors. Behavioral concepts are applied to develop dynamic and effective marketing strategies from the perspective of the marketing manager.

MBAD 6272. Marketing Analysis and Decision-Making. (3) Prerequisite(s): MBAD 6270. Planning, execution, analysis, and evaluation of marketing research activities. Emphasis on the techniques and methodology used in the collection, analysis, and interpretation of economic, demographic, and sociological data for use in marketing decision-making.

MBAD 6273. Product and Brand Strategy in the Connected World. (3) Prerequisite(s): MBAD 6270. Organizations are increasingly recognizing that the development of differentiated products and the creation of strong brands are fundamental strategic imperatives, as they are key to a wide range of important business outcomes. This trend is evidently strong in the connected world, where omnichannel businesses encompass brick-and-mortar and digital channels. In this course, the concepts, theories, and frameworks related to the creation and management of successful products and brands are explored. Special attention is paid to how the digital era has influenced product development (e.g., the rise of the sharing economy represented by Airbnb and Uber) and how the digital era has complicated brand management (e.g., the influence of online consumer reviews on brand equity). Also explored are the strategies that facilitate firms' success in the modern hyperconnected marketplace.

MBAD 6274. Advertising and Promotion Strategy. (3) Prerequisite(s): MBAD 6270. Opportunities and challenges for an organization through advertising, personal selling, sales promotion and publicity. Includes analysis of the legal and ethical problems involved in this area. Case studies and a project assignment are used.

MBAD 6275. Global Marketing Strategy. (3) Prerequisite(s): MBAD 6270. Study of opportunities, problems, and techniques involved in marketing globally. Analysis of environmental forces affecting global marketing and the methods used to market effectively on a global scale.

MBAD 6276. Consumer Analytics. (3) Cross-listed Course(s): DSBA 6276. Prerequisite(s): MBAD 6270 or permission of department. The utilization of analytics techniques in marketing decision-making and consumer strategy. Involves the extraction of hidden insight about consumers from structured and unstructured Big Data, and the translation of that insight into a market advantage. Applications in areas such as consumer targeting, product innovation, and promotion strategy.

MBAD 6277. Social Media Marketing and Analytics. (3) Cross-listed Course(s): DSBA 6277. Prerequisite(s): MBAD 6270 or permission of department. The utilization of social media in marketing strategy and tactics. Topics include: the use of social media in building brand strength and equity, as a customer acquisition tool, and as a customer relationship management tool. The utilization of analytics in effective social media marketing.

MBAD 6278. Innovation Analytics. (3) Cross-listed Course(s): DSBA 6278. Prerequisite(s): MBAD 6270 or permission of department. The comprehension and application of text analytics as a tool to examine unstructured qualitative information to generate innovations. Identifying the various sources of consumer insight and using them in innovation strategy. Understand how to differentiate between what consumers want versus what they say.

MBAD 6279. Design Thinking and Innovation. (3) Prerequisite(s): MBAD 6270. The theoretical and practical components of innovation. Introduction to design thinking and the innovation process from idea generation to early design to declaration of importance to delivery to the end user. Implementation of innovations.

MBAD 6280. Innovation and Change Strategy. (3) Prerequisite(s): MBAD 6270. The prediction and exploitation of marketplace change and the development of strategies to dominate future markets through innovative transformation. Frameworks to help market-driven organizations change before circumstances force them to do so and to create innovation-driven consumer strategy for the future. Understanding demographic and consumer trends.

MBAD 6281. Pricing and Positioning Strategy. (3) Prerequisite(s): MBAD 6270. Advances in pricing and positioning strategies. Topics include: marketing, economic, organizational, psychological, legal, and ethical factors of pricing strategies. Emphasis on current pricing and positioning techniques, such as conjoint analysis and hierarchical value analysis, and practice creating and using spreadsheet simulators to model consumer response to pricing and positioning decisions in competitive markets.

MBAD 6282. Marketing of Sports. (3) Prerequisite(s): MBAD 6270. Marketing concepts and practices applied to the marketing of sports products and services to the sports consumer. Emphasis on strategic marketing planning. Strategies to segment markets and identify customers; generate revenue, fan loyalty, and build the brand; collect and use marketing research data; promotional strategies including endorsements and sponsorships; pricing strategies (ticket prices) for sports teams/individuals in competition.

MBAD 6283. Mobile Marketing and Analytics. (3) Prerequisite(s): MBAD 6270 or permission of MBA Director. The utilization of mobile platforms, architecture, and security in marketing strategy and tactics. Topics include: developing an integrated mobile marketing campaign and global mobile marketing strategy. Understand how to analyze mobile data and the emerging market opportunities.

MBAD 6284. Digital Marketing Analytics. (3) Explores important techniques in marketing analytics with a focus on digital marketing applications. The primary purpose is to equip students with the essential data-analytical knowledge, methodologies and hands-on experiences in order for the students to have the ability and capability to address major marketing or business questions to make informative decisions. The course is structured on analyzing data through case studies, combined with lectures, discussion, and interactive hands-on exercises.

MBAD 6302. Evaluating Entrepreneurial Opportunities. (3) Examines how to assess the environmental conditions that surface opportunities for entrepreneurs, including competitor and industry, product, technological, sociocultural, political/legal, economic, and global trends. Students are also tasked with formulating innovative solutions to their discovered opportunities and assessing the attractiveness of their solutions via feasibility analysis.

MBAD 6304. Entrepreneurial Organizing. (3) Examines how entrepreneurs organize to exploit the opportunities they have recognized. Topics include: organizing rules; establishing routines; bootstrapping resources; market creation and market testing; and attracting, hiring, and selecting employees.

MBAD 6305. Entrepreneurship and Uncertainty. (3) Students perform a number of different tasks undefined until assigned during the semester. Potential tasks might include creating a website, putting together a point-of-sale advertisement, selling a thousand candy bars, or organizing an event such as a business plan competition. Students are rated equally and provided feedback on their behaviors and outcomes. Faculty provide limited guidance.

MBAD 6306. Corporate Entrepreneurship. (3) Examines the role of entrepreneurship within existing corporations. Topics not only consider how corporations can more effectively incentivize entrepreneurial activities within their boundaries, but also how individuals can more effectively mobilize support and act entrepreneurially within corporations. In addition, examines how and why new ventures are organized within established corporations.

MBAD 6309. Business Models and Business Plans. (3) Examines the formulation of business models and plans to detail how to appropriate value from recognized opportunities and innovative solutions. The business model captures a static view of the decisions needed to be made to create value, whereas the business plan provides a dynamic view of the decisions and investments needed to support a business's specific growth objectives.

MBAD 6310. Sports Economics. (3) Prerequisite(s): MBAD 5110 or equivalent. Economic concepts in the decision-making process as applied to sport. Topics include: demand and supply analysis and market structure in sports; market efficiency issues in sports; salary and ticket pricing issues in sports; economic impact studies of sports; and labor market studies in sports including collective bargaining agreements and discrimination. Regression analysis is covered and used in this course.

MBAD 6361. Management of Motorsports. (1.5) Prerequisite(s): MBAD 6161. The application of management concepts and theories to motorsports including leadership, structure, and human resources, especially labor relations. History of motorsports management including the role and impact of the media. Ownership, governance and governing bodies in motorsports, their authority and functions, eligibility requirements, and sanctions and appeals processes.

MBAD 6362. Management of Professional Team Sports. (1.5) Prerequisite(s): MBAD 6161. The application of management concepts and theories to the professional team's franchise including leadership, organizational design, and human resources, especially labor relations. History of professional team sports management in the United States and the world. Ownership, governance and governing bodies in professional sports including league organizations (major and minor), their authority and functions; eligibility requirements, and sanctions and appeals processes. In addition, the role and impact of television on professional team sports management will be explored.

MBAD 6500. Cooperative Education Experience. (0) Prerequisite(s): Completion of 9 credit hours of graduate coursework; and enrollment in Master's level program (Ph.D. level students are encouraged to contact their academic department to inquire about academic or industrial internship options for credit). Participation enables MBA students to pursue practical work experience that is complementary to their major course of studies. Each student's program must be approved by the director of the MBA program. Participating students pay a course registration fee for transcript notation and receive full-time student status. Assignments must be arranged and approved in advance. For more information, contact the University Career Center. *May be repeated. Graded on a Pass/Unsatisfactory basis.*

MBAD 6890. Directed Individual Study. (3) Prerequisite(s): Permission of a member of the graduate faculty who would direct the study and permission of the MBA Program Director. Directed individual study and in-depth analysis of a special area of management, economics, business or accounting. The course may be used to satisfy up to six credit hours of graduate credit requirements in the Master of Business Administration degree program. *May be repeated for credit with different area of study.*

MBAD 6962. Energy Markets. (3) Cross-listed Course(s): EMGT 5962. Prerequisite(s): Basic math and economics, or permission of instructor. Pre-or Corequisite(s): ECON 5181, EMGT 5961, or SEGR 4961. Energy and power systems in regulated and competitive environments and implications on business decisions for firms in these industries. Topics include: mechanism of energy markets; comparative market systems; determination of prices under different market structures; gas, oil, coal, and electricity market architecture; electricity market design; dispatch and new build decisions; smart grid and renewable energy in electricity markets; risk and risk management in energy including demand and price volatility and use of financial derivatives; and the impact of financial market trends and current and proposed policies on the energy industry.

MBAD 7090. Special Topics in Business. (1 to 4) Special topics in any of the functional areas of business. Topics will vary. *May be repeated for credit with change in topic.*

Middle Grades Education (MDLG)

MDLG 5130. The Middle Grades Experience. (2) Current curricular and instructional programs and their impact on the learning of contemporary early adolescents. Reform efforts currently underway in American schools that attempt to address issues surrounding these and other current practices. Developmental characteristics of the early adolescent learner. Clinical experience is required.

MDLG 6225. Issues in Middle Grades Education. (3) Cross-listed Course(s): EDCI 8225. Examination of educational practices in the middle grades (6 to 9), including trends and issues unique to that philosophy. Emphasis on broadening understanding of foundational components, organizational patterns, instructional programs, and management techniques.

MDLG 6800. Individual Study in Middle Grades Education. (1 to 6) Prerequisite(s): Permission of advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

Middle, Secondary, and K-12 Education (MDSK)

MDSK 5000. Topics in Middle and Secondary Education. (1 to 6) May include classroom and/or clinical experiences in the content area. With department approval, *May be repeated for credit with change of topic.*

MDSK 5100L. Content Pedagogy Lab. (1) Cross-listed Course(s): MDSK 4100L. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Corequisite(s): ENGL 5254, FLED 5200, MAED 5252, MDSK 5251, or MDSK 5253. Focuses on providing teacher education candidates exposure to the continued modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making within the content area (English, Foreign Language Education, Mathematics, Science, Social Studies).

MDSK 5101. Assessment of Middle Grades and Secondary School Learners in Science. (2) Cross-listed Course(s): MDSK 4101. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): MDSK 5100L and MDSK 5251. For current and future teachers of middle grades and secondary schools to develop multiple criteria assessment models and to master other competencies prescribed by the State of North Carolina, this course provides a foundation in the understanding of authentic assessment and its application in middle and secondary school science classrooms.

MDSK 5102. Assessment of Secondary School Learners in Mathematics. (2) Cross-listed Course(s): MDSK 4102. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): MDSK 5100L and MAED 5252. Fosters secondary mathematics education teacher candidates' knowledge of and skills for creating and implementing equitable assessments in K-12 classrooms. Learning modules provide an overview of the major principles involved in mathematics assessment, focusing on both theoretical and practical issues. Students practice creating/adapting, administering, and/or scoring both formative and summative assessments. Students take into account issues of equity and cultural relevance in this work. They also practice analyzing data from such assessments, making instructional decisions based on those data, and providing student feedback.

MDSK 5103. Assessment in Teaching Middle and Secondary Social Studies. (2) Cross-listed Course(s): MDSK 4103. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): MDSK 5100L and MDSK 5253. Prepares middle and secondary social studies teachers to plan and implement formal and informal assessments. Encompasses both authentic assessment and more traditional evaluation forms.

MDSK 5104. Assessment in Teaching K-12 English. (2) Cross-listed Course(s): MDSK 4104. Prerequisite(s): MDSK 5204, MDSK 6162, MDSK 6162L, and permission of department. Pre- or Corequisite(s): ENGL 5254 and MDSK 5100L. Supports current and future English Language Arts teachers as they critically analyze and develop appropriate and diverse assessments for learners. Approaches assessment as a method to support students' literacy development, with particular attention to the ways that assessment should align with and extend students' cultural and learning differences. Examines the alignment across standards and assessment methods and supports students in understanding the ways that assessment data can be analyzed and used to inform future teaching and lesson planning. Finally, students consider how they can engage learners in the assessment process to encourage learners to take responsibility for and ownership over their own learning.

MDSK 5105. Assessment in Teaching Career and Technical Education. (2) Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Pre- or Corequisite(s): MDSK 5100L and MDSK 5255. Fosters Career and Technical Education (CTE) teacher candidates' knowledge and skills of creating and implementing content and performance-based assessments in 6-12 classrooms. Learning modules provide an overview of the major principles involved in CTE assessment, focusing on both the theoretical and practical issues. Students practice creating, administering, and scoring assessments. They also practice analyzing data from such assessments, interpreting necessary changes in instruction based on those data, and providing student feedback.

MDSK 5204. Equity and Education. (2) Examination of issues of power, race, class, language, and privilege that affect the educational success of diverse student populations in today's public schools. Students explore effective strategies that meet the academic and socio-emotional needs of English Learners (ELs), populations at risk for school failure, and other diverse student communities. Particular consideration is given to building

mutually respectful relationships with diverse students, engaging parents/guardians/families from different cultural backgrounds, and creating and sustaining safe, caring, and inclusive classrooms using restorative practices that engender a positive learning environment.

MDSK 5251. Teaching Science to Middle and Secondary School Learners. (3) Cross-listed Course(s): MDSK 4251. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Corequisite(s): MDSK 5100L. Comprehensive overview of both science education and the nature of science. Planning and implementing effective learning experiences and assessment for both the number and the diversity of learners in a middle or secondary science classroom. Extensive clinical experience is required.

MDSK 5253. Teaching Social Studies to Middle and Secondary School Learners. (3) Cross-listed Course(s): MDSK 4253. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Corequisite(s): MDSK 5100L. Comprehensive overview of history and social studies education with an emphasis on providing opportunities for history and social studies teachers to create relevant, stimulating, content specific lessons for the diversity of students in middle or secondary schools. Extensive clinical experience is required.

MDSK 5255. Methods in Teaching Career and Technical Education. (3) Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Corequisite(s): MDSK 5100L. Fosters Career and Technical Education (CTE) teacher candidates' knowledge and skills of creating and implementing lessons in 6-12 CTE classrooms. Learning modules provide an overview of the major principles involved in business and marketing instruction, focusing on both the theoretical and practical issues. Students practice creating and implementing instruction. They also practice analyzing and reflecting upon their instruction for the purpose of making adjustments to improve practice. The course is to be taken in conjunction with a corequisite lab where candidates have the opportunity to rehearse strategies taught and receive peer and instructor feedback.

MDSK 5300. Content Area Instruction and Assessment. (3) Cross-listed Course(s): MDSK 4300. Prerequisite(s): MDSK 5204, MDSK 6162, and MDSK 6162L. Prepares candidates to plan and implement formal and informal assessments. Learning modules provide candidates opportunities to learn the major principles of various types of assessments; evaluate assessments for curriculum alignment and learning; evaluate assessments for bias; and develop and implement assessment in order to interpret K-12 content knowledge and provide student feedback and make future instructional decisions. The course also provides candidates exposure to the continued modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making within the content area.

MDSK 6142. Readings in Assessment, Measurement, and Student Achievement. (3) An examination of research-based assessment strategies for the 6-12 classroom. Practitioners construct appropriate assessment items with a focus on reliability and validity. Interpretation and utilization of student outcomes to improve classroom practice is emphasized. No clinical experience required.

MDSK 6150. Models of Teaching. (3) Learning theory associated with information processing, personal, social, and behavioral models; current trends in instructional methodology for a variety of content areas.

MDSK 6156. Curriculum, Teaching, and Contemporary Issues in Education. (3) A consolidated examination of curriculum and learning theory with emphasis on educational reform and the origins of contemporary issues in education. Merges curriculum and learning theory to examine contemporary issues in education. Drawing from the field of curriculum studies, attention is given to historical roots of curriculum and important theorists, educational reform and the change process, as well as global comparisons among American and international educational systems. Approaches learning theory associated with information processing, personal, social, and behavior models as a foundation of current content area instructional methodology.

MDSK 6162. Planning for K-12 Instruction. (2) Corequisite(s): MDSK 6162L. Introduction to the systematic process of planning for effective instruction, assessment, technology integration, and classroom leadership. Clinical experience is required.

MDSK 6162L. Instructional Design Lab. (1) Corequisite(s): MDSK 6162. Focuses on providing teacher education candidates exposure to the modeling of evidence-validated practices, the rehearsal of instructional tasks, and numerous opportunities for feedback on pedagogical decision-making. This lab, taken in conjunction with an introductory course on lesson plan design, affords novice educators opportunities to practice and rehearse focus practices and receive feedback and coaching from an expert instructor. Engaging in a cycle of practice-based teacher education, candidates receive modeling and are exposed to other representations of practice.

MDSK 6220. Adolescence and Learning. (2 or 3) Study of adolescence as a phase of development and its relationship to the learning process.

MDSK 6250. Issues in 6-12 Science Education. (3) Orientation to content, curriculum and methods appropriate for teaching science. Emphasis is on a critical

examination of current trends and practices in the teaching of science.

MDSK 6251. Issues in 6-12 Mathematics Education. (3) Orientation to content, curriculum and methods appropriate for teaching mathematics. Emphasis is on critical examination of current trends and practices in the teaching of mathematics.

MDSK 6254. Issues in 6-12 Social Studies Education. (3) Current issues in teaching and learning social studies. Emphasis on current trends in curriculum, advanced instructional methods, and research.

MDSK 6260. Teacher Leadership. (3) An examination of the current research on adult learning and development, expert knowledge, and the professionalization of the field of teaching. Students develop skills to direct other educational professionals.

MDSK 6351. Advanced Methods in Middle and Secondary Science. (3) Examination of current research and scholarship on the teaching of science in middle and secondary schools. Particular emphasis on the development of advanced instructional expertise and leadership.

MDSK 6354. Advanced Methods in Middle and Secondary Social Studies. (3) Examination of current research and scholarship on the teaching of social studies in middle and secondary schools. Particular emphasis on the development of advanced instructional expertise and leadership.

MDSK 6355. Advanced Methods of Teaching Career and Technical Education (CTE). (3) A variety of topics are addressed in order to prepare experienced Career and Technical Education teachers to become leaders in the field by developing as critical thinkers, researchers in the curriculum area, as well as instructional and program leaders. Topics include: theories of CTE acquisition, the history and trends of CTE instructional methods, curriculum design, research-based practices, community partnerships, and mentoring of beginning teachers.

MDSK 6356. Curriculum Studies. (3) Examination of the field of curriculum study with particular emphasis on the change process.

MDSK 6464. Primary and Secondary Source Analysis. (3) Advanced content course for middle and secondary social studies teachers seeking advanced social studies licensure. Provides a focused study of primary and secondary sources that effectively support middle and secondary student understanding of social studies content. Emphases include increased content knowledge of social studies, extensive content research and reading, development of content resources, application of advanced instructional methods through the integration of content resources to support student learning of social studies content, and experience in curriculum evaluation.

MDSK 6470. Graduate Student Teaching and Internship. (3 to 6) Prerequisite(s): completion of all coursework required for the "A" license completion of an application for the course by the established deadline, and approval of the department. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

MDSK 6691. Seminar in Professional Development. (3) Seminar focused on the self-direction and professional development of teachers. Emphasis placed on the design, development, and completion of the candidate's comprehensive portfolio, thesis, or research project.

Mechanical Engineering (MEGR)

MEGR 5090. Special Topics in Mechanical Engineering. (3) Cross-listed Course(s): MEGR 4090. Prerequisite(s): Mechanical Engineering major. Builds upon and synthesizes the knowledge that students have gained from the mechanical engineering core curriculum. The specific topics covered in each separate offering of the course serves as the means for teaching engineering analysis, synthesis, and/or design. *May be repeated for credit with change of topic.*

MEGR 5092. Special Topics in Motorsports Engineering. (3) Cross-listed Course(s): MEGR 4092. Prerequisite(s): Mechanical Engineering major. Builds upon and synthesizes the knowledge gained from the mechanical engineering core curriculum. The specific topics covered in each separate offering of the course serve as the means for teaching engineering analysis, synthesis, and/or design in topics that relate to Motorsports Engineering. *May be repeated for credit with change of topic.*

MEGR 5094. Special Topics in Energy Engineering. (3) Cross-listed Course(s): MEGR 4094. Prerequisite(s): Mechanical Engineering major. Builds upon and synthesizes the knowledge gained from the mechanical engineering core curriculum. The specific topics covered in each separate offering of the course serve as the means for teaching engineering analysis, synthesis, and/or

design in topics that relate to Energy Engineering. *May be repeated for credit with change of topic.*

MEGR 5097. Special Topics in Biomedical Engineering. (3) Cross-listed Course(s): MEGR 4097. Prerequisite(s): Mechanical Engineering major. Builds upon and synthesizes the knowledge that students have gained from the mechanical engineering core curriculum. The specific topics covered in each separate offering of the course serves as the means for teaching engineering analysis, synthesis, and/or design in topics that relate to Biomedical Engineering. *May be repeated for credit with change of topic.*

MEGR 5098. Special Topics in Precision Engineering. (3) Cross-listed Course(s): MEGR 4098. Prerequisite(s): Mechanical Engineering major. Builds upon and synthesizes the knowledge that the students have gained from the mechanical engineering core curriculum. The specific topics covered in each separate offering of the course serve as the means for teaching engineering analysis, synthesis, and/or design. *May be repeated for credit with change of topic.*

MEGR 5143. Mechanical Vibrating Systems. (3) Cross-listed Course(s): MEGR 4143. Prerequisite(s): Mechanical Engineering major. Analysis of vibrations and dynamics. Topics include: classical mechanics, single degree of freedom systems, multi-degree of freedom systems, continuous systems, single degree of freedom nonlinear systems, random vibrations, and spectral analysis.

MEGR 5210. Automotive Powerplants. (3) Cross-listed Course(s): MEGR 4210. Prerequisite(s): Mechanical Engineering major. The engineering principles governing internal combustion engine theory, design, and applications.

MEGR 5211. Road Vehicle Dynamics. (3) Cross-listed Course(s): MEGR 4211. Prerequisite(s): Mechanical Engineering major. Topics related to vehicle dynamics and modeling thereof. Acceleration and braking performance, road loads, steady-state cornering, suspension, steering system, and tire behavior.

MEGR 5235. Waves and Optics. (3) Cross-listed Course(s): MEGR 4235. Prerequisite(s): Mechanical Engineering major. An introductory study of optics covering geometrical optics, optical instruments, wave optics (interference and diffraction), Fourier analysis, and polarization.

MEGR 5237. Introduction to Control Systems. (3) Cross-listed Course(s): MEGR 4237. Prerequisite(s): Mechanical Engineering major. Fundamentals of classical control analysis and design. Topics include: modeling and analyzing control systems; design of automatic controllers.

MEGR 5240. Advanced Automotive Powerplants. (3) Cross-listed Course(s): MEGR 4240. Prerequisite(s): MEGR 5210 and Mechanical Engineering major. Advanced engineering principles governing internal combustion engine theory, design, and application.

MEGR 5242. Applied Vehicle Aerodynamics. (3) Cross-listed Course(s): MEGR 4242. Prerequisite(s): Mechanical Engineering major. Flow of air around streamlined and bluff bodies, aerodynamic forces, understanding flow separation and reattachments, aerodynamic tools, introduction to computational fluid dynamics, use of commercial CFD packages to solve fluid flow problems, computer simulation and analysis of flow around bluff bodies and road vehicles, including race cars.

MEGR 5244. Tire Mechanics. (3) Cross-listed Course(s): MEGR 4244. Prerequisite(s): Mechanical Engineering major. In-depth analysis of the tire and its influence on vehicle performance, including: design, materials, construction, structural response, rolling resistance, force and moment generation, NVH, wet and dry traction, wear, high speed limit, and standards. Tire models, their limitations, and their governing equations.

MEGR 5271. Orthopedic Biomechanics. (3) Cross-listed Course(s): MEGR 4271. Prerequisite(s): Mechanical Engineering major. Introduces mechanical properties of the human body's hard tissues (bone and cartilage) and soft tissues (muscles, ligament, and tendon), and joint biomechanics. Focuses on mechanical and biological considerations for treatment of orthopedic diseases and sports injuries, such as bone fractures, ACL injury, and osteoarthritis. Students learn to solve medical problems using their engineering knowledge and skills.

MEGR 5272. Mechanics of the Human Locomotor System. (3) Cross-listed Course(s): MEGR 4272. Prerequisite(s): Mechanical Engineering major. Introduces dynamic analysis of the human musculoskeletal system. Students learn to develop 3-D rigid body models of human movement, and how to calculate internal forces in muscles and joints during daily and sports activities. Students also learn how to use motion capture system and simulation software of human locomotion.

MEGR 5273. Regenerative Neural Engineering. (3) Cross-listed Course(s): MEGR 4273. Prerequisite(s): Mechanical Engineering major. The basic principles of neuroscience and biomedical engineering, and the use of these principles in regenerative neural engineering. Topics include: the state of the art in the use of advanced 3D bioprinting, stem cells, conductive materials, nanomaterials, neural modeling, and brain machine interfaces as applied to solving prevalent clinical issues related to neurology.

MEGR 5274. Bioelectronic Medicine. (3) Cross-listed Course(s): MEGR 4274. Prerequisite(s): Mechanical Engineering major. The basic principles of neuroscience and neural engineering, and the use of engineering principles in bioelectronic medicine. Topics include: the use of optogenetics, electrical stimulation, electromagnetic stimulation, and brain machine Interfaces as applied to solving prevalent clinical issues related to neurology and neural engineering.

MEGR 5280. Advanced Manufacturing Processes. (3) Cross-listed Course(s): MEGR 4280. Prerequisite(s): Mechanical Engineering major. Detailed analytical treatment of manufacturing materials, processes, and procedures. Forming processes, casting processes, metal cutting processes, tool materials, joining processes, automation, and economics.

MEGR 6000. Research Seminar. (1) Presentations on the current research in Mechanical Engineering, Engineering Science, and related fields. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

MEGR 6090. Special Topics in Mechanical Engineering. (3) Prerequisite(s): Mechanical Engineering major. Directed study of current topics of special interest. *May be repeated for credit.*

MEGR 6109. Biotechnology and Bioengineering. (3) Cross-listed Course(s): MEGR 8109. Prerequisite(s): admission to a graduate program or permission of instructor(s). This interdisciplinary course discusses key issues in device design, and heat and mass transport with cell biology, molecular biology, and physiology to introduce students to technological innovations in biotechnology and bioengineering. Credit will not be awarded for MEGR 6109 where credit has been awarded for MEGR 8109.

MEGR 6116. Fundamentals of Heat Transfer and Fluid Flow. (3) Cross-listed Course(s): MEGR 8116. Prerequisite(s): MEGR 3114 or equivalent. A unified treatment of transfer operations developed in terms of physical rate processes; formulation and solution of typical boundary value problems associated with heat, mass and momentum transfer. Credit will not be awarded for MEGR 6116 where credit has been awarded for MEGR 8116.

MEGR 6125. Vibrations of Continuous Systems. (3) Cross-listed Course(s): MEGR 8125. Prerequisite(s): MEGR 4143 or equivalent. Analysis of vibration of continuous linear elastic structures such as strings, rods, beams and plates with varying boundary conditions. Approximate solution techniques such as Rayleigh, Rayleigh-Ritz, and Galerkin are presented. Credit will not be awarded for MEGR 6125 where credit has been awarded for MEGR 8125.

MEGR 6141. Theory of Elasticity I. (3) Cross-listed Course(s): MEGR 8141. Prerequisite(s): MEGR 3221 or equivalent. Introduction to the theory of elastic media; the fundamentals of stress, strain, stress-strain relationships, compatibility and equilibrium. Applications to two- and three-dimensional problems. Structural mechanics and energy methods. Credit will not be awarded for MEGR 6141 where credit has been awarded for MEGR 8141.

MEGR 6166. Mechanical Behavior of Materials I. (3) Cross-listed Course(s): MEGR 8166. Prerequisite(s): MEGR 3161 or equivalent. Macroscopic and microscopic aspects of elastic and plastic deformation and fracture of engineering materials; applications of dislocation theory to an interpretation and control of mechanical properties; temperature, strain rate and texture effects. Credit will not be awarded for MEGR 6166 where credit has been awarded for MEGR 8166.

MEGR 6181. Engineering Metrology. (3) Cross-listed Course(s): MEGR 8181, OPTI 6381, and OPTI 8381. Prerequisite(s): MEGR 3282 or equivalent. Introduction to metrology and standards. Uncertainty, precision and accuracy in metrology. Measurement of size and form, computational methods in measurement of form. Measurement of surface texture and out of roundness. Machine tool and robot accuracy and calibration. Evaluation of screw threads and gears. Introduction to design of precision instruments. Credit will not be awarded for MEGR 6181 where credit has been awarded for MEGR 8181.

MEGR 6990. Industrial Internship. (1 to 3) Cross-listed Course(s): MEGR 8990. Prerequisite(s): Completion of nine hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director. Requires a mid-term report and final report to be graded by the supervising faculty.

MEGR 7090. Special Topics in Mechanical Engineering. (3) Directed study of current topics of special interest for Master's degree. *May be repeated for credit.*

MEGR 7101. Transport Processes. (3) Cross-listed Course(s): MEGR 8101. Prerequisite(s): permission of department. Unified field theory approach to the fluid transport of momentum, energy, mass and electrical charge. Statistical theories of turbulence and molecular transport. Multiphase systems, chemically reacting flows, ionized fluids, separation processes. Credit will not be awarded for MEGR 7101 where credit has been awarded for MEGR 8101.

MEGR 7102. Introduction to Continua. (3) Cross-listed Course(s): MEGR 8102. Prerequisite(s): MEGR 2144 and MEGR 3114 or equivalents, or permission of department. A unified treatment of those topics which are common to all continua. Stress, deformation and velocity fields, constitutive equations and field equations. Representative applications in solid, fluid and electromagnetic continua, including interaction problems. Credit will not be awarded for MEGR 7102 where credit has been awarded for MEGR 8102.

MEGR 7104. Fabrication of Nanomaterials. (3) Cross-listed Course(s): MEGR 8104. Prerequisite(s): NANO 8101 or permission of instructor. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Credit will not be awarded for MEGR 7104 where credit has been awarded for MEGR 8104.

MEGR 7104. Fabrication of Nanomaterials. (3) Cross-listed Course(s): ECGR 7104 and MEGR 8104. Prerequisite(s): NANO 8101 or permission of instructor. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Credit will not be awarded for MEGR 7104 where credit has been awarded for ECGR 7104 or MEGR 8104.

MEGR 7108. Finite Element Analysis and Applications. (3) Cross-listed Course(s): MEGR 8108. Prerequisite(s): MEGR 6141 and MATH 6171 or permission of department. An introduction to the finite element method and its application to engineering problems. Application of the displacement methods to plane stress, plane strain, plate bending and axisymmetrical bodies. Topics may include, but are not limited to: dynamics, heat conduction, and structural mechanics. Credit will not be awarded for MEGR 7108 where credit has been awarded for MEGR 8108.

MEGR 7110. Advanced Conductive Heat Transfer. (3) Cross-listed Course(s): MEGR 8110. Prerequisite(s): MEGR 3116 or equivalent. Theory of steady and unsteady heat conduction in isotropic and anisotropic media. Treatment of concentrated and distributed heat sources. Application of the finite difference and finite element methods. Credit will not be awarded for MEGR 7110 where credit has been awarded for MEGR 8110.

MEGR 7111. Advanced Engineering Thermodynamics. (3) Cross-listed Course(s): MEGR 8111. Prerequisite(s): MEGR 3112 and MATH 3142, or equivalents. Postulational treatment of the laws of thermodynamics. Equilibrium and maximum entropy postulates. Development of formal relationships and principles for general systems. Applications to chemical, magnetic, electric, and elastic systems. Credit will not be awarded for MEGR 7111 where credit has been awarded for MEGR 8111.

MEGR 7112. Radiative Heat Transfer. (3) Cross-listed Course(s): MEGR 8112. Prerequisite(s): MEGR 3116 or equivalent. Fundamentals of radiation heat transfer, analysis of gray body and wavelength dependent systems; radiation from gases at high temperature, and particulate-laden gases; combined radiation and conduction. Credit will not be awarded for MEGR 7112 where credit has been awarded for MEGR 8112.

MEGR 7113. Dynamics and Thermodynamics of Compressible Flow. (3) Cross-listed Course(s): MEGR 8113. Prerequisite(s): MEGR 3111 and MEGR 3114, or equivalents. Compressible flow equations, isentropic flow, normal shock waves, Fanno and Rayleigh line flows. Nonsteady one dimensional flow. Credit will not be awarded for MEGR 7113 where credit has been awarded for MEGR 8113.

MEGR 7114. Advanced Fluid Mechanics. (3) Cross-listed Course(s): MEGR 8114. Prerequisite(s): MEGR 4112 or equivalent. Unified tensorial-theoretical treatment of the transport of mass, momentum, energy and voracity in fluids. General theorems for inviscid and irrational flows. Viscous effects, boundary layer theory, nonlinear phenomena hydrodynamic instability and turbulence with applications. Credit will not be awarded for MEGR 7114 where credit has been awarded for MEGR 8114.

MEGR 7115. Convective Heat Transfer. (3) Cross-listed Course(s): MEGR 8115. Prerequisite(s): MEGR 3116 and MEGR 4112, or equivalents. Heat and momentum transfer prediction in channel flows and boundary layers. Differential equation methods for fully developed and entry length laminar tube flows. Similarity solution for laminar heat transfer. Superposition methods for non-uniform boundary conditions. Integral equations of the boundary layer, approximate and semiempirical methods of solution. Credit will not be awarded for MEGR 7115 where credit has been awarded for MEGR 8115.

MEGR 7117. Statistical Thermodynamics. (3) Cross-listed Course(s): MEGR 8117. Quantum mechanics-based statistical mechanics. Equilibrium macroscopic and microscopic thermodynamic states. Ensemble theory, including classical phase spaces, Liouville theorem, quantum modifications, and Gibbs microcanonical, canonical, and grand canonical ensembles. Introduction to

quantum mechanics, including Hamiltonian systems, the density matrix, and quantum statistics. Theory of ideal quantum gases and non-interacting Boson and Fermi-Dirac systems.

MEGR 7118. Thermal Environmental Engineering. (3) Cross-listed Course(s): MEGR 8118. Prerequisite(s): MEGR 3116 or equivalent. Application of the thermodynamic and heat transfer principles to the analysis of thermal environmental systems. Topics include: thermodynamic properties of moist air, psychometric charts, transfer processes, heating and cooling of moist air coils, physiological effects of thermal environments, food processing and storage. Credit will not be awarded for MEGR 7118 where credit has been awarded for MEGR 8118.

MEGR 7119. Thermal Applications in Biomedical Engineering. (3) Cross-listed Course(s): MEGR 8119. Prerequisite(s): permission of department. Application of thermodynamic and heat transfer principles to the analysis of biomedical systems. Topics include: thermodynamic and transport properties of biological tissue, thermoregulation, design and use of cryosurgical probes, and numerical modeling methods. Credit will not be awarded for MEGR 7119 where credit has been awarded for MEGR 8119.

MEGR 7120. Bearing Design and Lubrication. (3) Cross-listed Course(s): MEGR 8120. Prerequisite(s): MEGR 3222 or equivalent. Hydrodynamic lubrication, fluid film and rolling element bearings, design and control of gas and fluid lubricated bearings. Credit will not be awarded for MEGR 7120 where credit has been awarded for MEGR 8120.

MEGR 7121. Mechanism Analysis. (3) Cross-listed Course(s): MEGR 8121. Prerequisite(s): MEGR 3221 or equivalent, or permission of department. Analysis of coplanar and spatial mechanisms, application of matrix methods in analysis of mechanisms, mobility analysis of mechanisms, rigid body guidance, computer-aided analysis of mechanisms. Credit will not be awarded for MEGR 7121 where credit has been awarded for MEGR 8121.

MEGR 7122. Mechanism Synthesis. (3) Cross-listed Course(s): MEGR 8122. Prerequisite(s): MEGR 7121 or permission of department. Synthesis of coplanar and spatial mechanisms, number and type synthesis, function generator, path generator, optimal synthesis of mechanisms, case studies in optimal design of mechanisms. Credit will not be awarded for MEGR 7122 where credit has been awarded for MEGR 8122.

MEGR 7123. Mechanical Design. (3) Cross-listed Course(s): MEGR 8123. Prerequisite(s): MEGR 6141 or permission of department. Impact loading on critical sections, fatigue consideration, stress concentration, fluctuating stresses, failure analysis, contact stresses, industrial case studies. Credit will not be awarded for MEGR 7123 where credit has been awarded for MEGR 8123.

MEGR 7124. Introduction to Automatic Controls. (3) Cross-listed Course(s): MEGR 8124. Prerequisite(s): permission of department. Emphasis on mechanical systems. Mathematical models and characteristics of control systems. Performance and stability of linear feedback systems. Root locus and frequency response techniques. State space methods. Design and compensation of control systems. Credit will not be awarded for MEGR 7124 where credit has been awarded for MEGR 8124.

MEGR 7126. Dynamics of Machinery. (3) Cross-listed Course(s): MEGR 8126. Prerequisite(s): MEGR 3221 or equivalent, or permission of department. Application of dynamics of machinery, balancing of rigid and flexible rotors. Dynamics of spatial mechanisms. Computer-aided dynamic analysis of machinery. Credit will not be awarded for MEGR 7126 where credit has been awarded for MEGR 8126.

MEGR 7127. Computer-Aided Manufacturing. (3) Cross-listed Course(s): MEGR 8127. Prerequisite(s): MEGR 3255 or permission of department. Topics include: flowline production, numerical control, computer-aided process monitoring and control, group technology, flexible manufacturing, and material requirement planning. Credit will not be awarded for MEGR 7127 where credit has been awarded for MEGR 8127.

MEGR 7128. Control of Robotic Manipulators. (3) Cross-listed Course(s): ECGR 5161 and MEGR 8128. Prerequisite(s): MEGR 4127, ECGR 4151, or equivalent. Control of industrial robots including linear, nonlinear, and adaptive control of the motion of robots; plus control of forces and torques exerted by the end-effector. Additional topics include computer animation of the controlled behavior of industrial robots, actuators and sensors, robot vision and artificial intelligence, and control computer/robot interfacing. Credit will not be awarded for MEGR 7128 where credit has been awarded for MEGR 8128.

MEGR 7129. Structural Dynamics of Production Machinery. (3) Cross-listed Course(s): MEGR 8129. Prerequisite(s): permission of department. The analytical study of dynamic characteristics of production machinery and the corresponding measurement, specification, and effects on machine performance. Machine tool vibration, machine tool stability, high speed machining. Credit will not be awarded for MEGR 7129 where credit has been awarded for MEGR 8129.

MEGR 7130. Introduction to Control Systems (3) Cross-listed Course(s): MEGR 8130. Introduction to key principles behind feedback control, including closed-loop time

domain and frequency domain analysis, root locus design, state feedback, robustness margins, and loop shaping.

MEGR 7131. Automotive Power Plants. (3) Cross-listed Course(s): MEGR 8131. Energy analysis of internal and external combustion engines for vehicular propulsion. Thermodynamic principles for combustion efficient use of fuel combustion, different types of fuel use, and pollutant control.

MEGR 7132. Advanced Automotive Power Plants. (3) Cross-listed Course(s): MEGR 8132. Prerequisite(s): MEGR 7131 or MEGR 8131. Follow-up course to Automotive Power Plants. Topics include: combustion, thermodynamic efficiency, fuel efficiency, torque and power, emissions, etc.

MEGR 7133. Applied Vehicle Aerodynamics. (3) Cross-listed Course(s): MEGR 8133. Prerequisite(s): Foundational knowledge of fluid mechanics and numerical methods in engineering applications. Examination of the flow of air around streamlined and bluff bodies, aerodynamic forces, understanding flow separation and reattachments, aerodynamic tools, introduction to computational fluid dynamics, use of commercial CFD packages to solve fluid flow problems, computer simulation, and analysis of flow around bluff bodies and road vehicles, including racecars.

MEGR 7134. Advanced Road Vehicle Dynamics. (3) Cross-listed Course(s): MEGR 8134. Prerequisite(s): MEGR 3121, MEGR 3122, and MATH 2171. Advanced topics related to vehicle dynamics and modeling. Acceleration and braking performance, road loads, steady-state cornering, suspension, steering system, and tire behavior are explored.

MEGR 7135. Advanced Tire Mechanics. (3) Cross-listed Course(s): MEGR 8135. Prerequisite(s): MEGR 2144 and MEGR 3121 with grades of C or above. In-depth analysis of the tire and its influence on vehicle performance, including: design, materials, construction, structural response, rolling resistance, force and moment generation, NVH, wet and dry traction, wear, high speed limit, and standards. Tire models, their limitations, and their governing equations. Graduate students develop an experiment (in addition to a literature review), gather data, submit an abstract to the Fall Tire Society Conference, and write a rough draft of a paper.

MEGR 7136. Automotive Materials. (3) Cross-listed Course(s): MEGR 8136. A broad range of automotive materials from steel, aluminum to new materials, such as composite materials. During the class, students are tutored to understand how the industry selects, designs, manufactures, and applies materials for automobiles in general, and what are current applications of various available materials in the automotive industry. Emphasis on structural materials where crashworthiness and structural integrity are important. Basic understanding of mechanics of materials; e.g., Introduction of Solid Mechanics, Introduction of Material Engineering, Mechanics of Materials.

MEGR 7142. Theory of Elasticity II. (3) Cross-listed Course(s): MEGR 8142. Prerequisite(s): MEGR 6141 and MATH 6172. Continuation of MEGR 6141 with additional topics in three-dimensional analyses. Topics include: complex variable techniques, variational methods and numerical techniques. Credit will not be awarded for MEGR 7142 where credit has been awarded for MEGR 8142.

MEGR 7143. Inelastic Behavior of Materials. (3) Cross-listed Course(s): MEGR 8143. Prerequisite(s): MEGR 6141 or permission of department. Introduction to plasticity and linear viscoelasticity. Topics include: a study of yield criteria, plastic stress-strain relations, plastic hinge analysis, discrete viscoelastic models, the hereditary integral and selected boundary value problems. Credit will not be awarded for MEGR 7143 where credit has been awarded for MEGR 8143.

MEGR 7145. Advanced Topics in Dynamics. (3) Cross-listed Course(s): MEGR 8145. Prerequisite(s): permission of department. Selected advanced topics in dynamics such as Lagrangian dynamics, vibrations of continuous media, stress wave propagation, and motion measurement. Credit will not be awarded for MEGR 7145 where credit has been awarded for MEGR 8145.

MEGR 7146. Experimental Stress Analysis. (3) Cross-listed Course(s): MEGR 8146. Prerequisite(s): MEGR 6141 or permission of department. Theoretical and experimental techniques of stress and strain analysis, with experimental emphasis on strain gages and instrumentation. Brittle coatings and photoelasticity are also considered. Two lectures and a two-hour lab per week. Credit will not be awarded for MEGR 7146 where credit has been awarded for MEGR 8146.

MEGR 7147. Flight Dynamics. (3) Cross-listed Course(s): MEGR 8147. Prerequisite(s): MEGR 3122 with a grade of B or above. Introduction to key principles behind steady and unsteady flight regimes. Specifically, steady level, ascending, and crosswind flight, along with the corresponding flight envelopes. Full six degree-of-freedom equations of motion are derived for fixed-wing aircraft and aircraft with spinning rotors. Longitudinal and lateral flight modes are analyzed based on the linearized dynamic equations.

MEGR 7148. Stability and Control of Nonlinear Systems. (3) Cross-listed Course(s): MEGR 8148. Prerequisite(s): Graduate standing and knowledge of linear systems

theory/linear control design. Introduction to key principles behind the stability and control of nonlinear systems, including internal and external stability, Lyapunov-based stability analysis, analysis of limit cycle behavior, orbital/set stability, linearization-based control, feedback linearization, and periodic control.

MEGR 7151. Orthopedic Biomechanics. (3) Cross-listed Course(s): MEGR 8151. Prerequisite(s): Permission of instructor. Introduces mechanical properties of the human body's hard tissues (bone and cartilage) and soft tissues (ligament and tendon). Focus is placed on mechanical and biological considerations for treatment of orthopedic diseases and sports injuries, such as fracture, ACL injury, and osteoarthritis. Students learn how to solve medical problems using their engineering knowledge and skills, such as finite element analysis and inverse dynamics.

MEGR 7152. Mechanics of the Human Locomotor System. (3) Cross-listed Course(s): MEGR 8152. Prerequisite(s): Permission of instructor. Introduces dynamic analysis of the human musculoskeletal system. Students learn to develop 3-D rigid body models of human movement, calculate internal forces in muscles and joints during daily and sports activities, and how to use motion capture system and simulation software of human locomotion.

MEGR 7161. Atomic Processes in Solids. (3) Cross-listed Course(s): MEGR 8161. Prerequisite(s): MEGR 2144 or equivalent, or permission of department. Processes dependent on large- and small-scale atomic motions leading to changes in material structures and properties. Theories of diffusion controlled and diffusionless transformations. Modern concepts in structure and property control. Credit will not be awarded for MEGR 7161 where credit has been awarded for MEGR 8161.

MEGR 7163. Materials Characterization and Analysis. (3) Cross-listed Course(s): MEGR 8163. Designed for graduate students to gain an in-depth understanding of principal methods in materials characterization and analysis. Students learn different techniques of materials characterization and analysis, including: (1) structure identification using electron and X-ray diffractions, (2) morphology study using electron microscopy, (3) composition and chemical state determination using electron spectroscopy and other techniques. Focuses on fundamental concepts of different methods, as well as hands-on experience. Well-designed lab sessions are provided for students to practice selected techniques using different instruments (e.g., XRD, SEM, EDS, and sputtering coating).

MEGR 7164. Diffraction/Spectroscopic Studies of Matter. (3) Cross-listed Course(s): MEGR 8164. Prerequisite(s): permission of department. Atomic arrangements in crystalline and non-crystalline forms of matter. Symmetry properties of crystals. Treatment of diffraction theory and experimental methods. X-ray diffraction and spectroscopic analysis of matter. Credit will not be awarded for MEGR 7164 where credit has been awarded for MEGR 8164.

MEGR 7165. Diffraction and NDE Methods in Materials Science. (3) Cross-listed Course(s): MEGR 8165. Prerequisite(s): MEGR 3161 or equivalent or permission of department. Principles of diffraction and non-destructive evaluation methods and their applications to material problems; characterization of atomic and microstructural features and process induced defects in materials; evaluation of residual stress and texture effects; phase and elemental analysis; experimental methodologies. Credit will not be awarded for MEGR 7165 where credit has been awarded for MEGR 8165.

MEGR 7166. Deformation and Fracture of Materials. (3) Cross-listed Course(s): MEGR 8168. Prerequisite(s): permission of department. Macroscopic and microscopic aspects of elastic and plastic deformation and fracture; applications of dislocation theory to an interpretation and control of mechanical properties; temperature, strain rate and texture effects. Credit will not be awarded for MEGR 7166 where credit has been awarded for MEGR 8166.

MEGR 7167. Mechanical Behavior of Materials II. (3) Cross-listed Course(s): MEGR 8167. Prerequisite(s): MEGR 6166 or equivalent. Continuation of MEGR 6166. Topics include: further treatments of dislocation theory and its applications; analysis of fatigue and creep phenomena; strength of polymers and composites; statistical treatment of strength; materials design and failure analysis. Credit will not be awarded for MEGR 7167 where credit has been awarded for MEGR 8167.

MEGR 7169. Introduction to Transmission Electron Microscopy. (3) Cross-listed Course(s): MEGR 8169. Designed for graduate students with various academic backgrounds, including engineering, nanoscale science, physics, chemistry, and biology. Introduces the theoretical and practical concepts of transmission electron microscopy (TEM). Topics include: basic instrumentation of TEM, diffraction, imaging, and microanalysis. In addition to classroom lectures, students have opportunities to gain hands-on experience of operating a state-of-the-art TEM system and several sample preparation tools. The course consists of weekly lectures and weekly lab sections. The final grade is determined based on homework, lab reports, and examinations.

MEGR 7172. Computational Methods in Engineering. (3) Cross-listed Course(s): MEGR 8172. Numerical linear algebra, solution of systems of equations, numerical integration, differentiation and interpolation, root finding, numerical solution of partial differential equations by finite difference and finite element methods. Credit will not be

awarded for MEGR 7172 where credit has been awarded for MEGR 8172.

MEGR 7173. Engineering Design Optimization. (3) Cross-listed Course(s): MEGR 8173. Prerequisite(s): Permission of instructor and programming knowledge in C, C++, FORTRAN, or Matlab. Concepts of optimization and associated terminology. Proper optimization formulation and application in engineering design. Methods for simulation-based optimization with approximation techniques. Credit will not be awarded for MEGR 7173 where credit has been awarded for MEGR 8173.

MEGR 7174. Engineering Analysis I. (3) Cross-listed Course(s): MEGR 8174. An overview of Ordinary Differential Equations, Partial Differential Equations, Fourier series, and Laplace Transforms.

MEGR 7175. Engineering Analysis II. (3) Cross-listed Course(s): MEGR 8175. An overview of Linear Algebra, including Matrix-Matrix operations, types of matrices, Gaussian Elimination, Rank of a Matrix, Eigenvalues and Eigenvectors, Singular Value Decomposition, Approximations of Functions with Fourier Series, Discrete Fourier Transform, Hankel Transform, Orthogonal Polynomials.

MEGR 7182. Machine Tool Metrology. (3) Cross-listed Course(s): MEGR 8182. Prerequisite(s): MEGR 2180 or equivalent, MEGR 3281, and MEGR 6181. Machine tool accuracy and performance testing. Modeling and measurement of volumetric accuracy using parametric error separation and quasi-static error models. Use of homogeneous transformations for error mapping. Linear and higher order thermal models. Error budgeting and management. Axis of rotation metrology, spindle accuracy, and cutting performance tests. Laboratory experience on CNC machine tools using heterodyne laser interferometers, capacitance gages, and other computer assisted sensor systems for machine checking. Credit will not be awarded for MEGR 7182 where credit has been awarded for MEGR 8182.

MEGR 7183. Design of Precision Machines and Instruments I. (3) Cross-listed Course(s): MEGR 8183. Prerequisite(s): MEGR 3221 or equivalent, and MEGR 7182. Basic patterns in the design of precision machines and instruments. Design process, error assessment and examples, materials, sensors, drives, and controls for precision machines. Machine frames, sliding and rolling element bearings, flexures, hydrostatic bearings. Design methodology, analysis of potential design, design case studies, and modeling of design alternatives. Credit will not be awarded for MEGR 7183 where credit has been awarded for MEGR 8183.

MEGR 7184. Design of Precision Machines and Instruments II. (3) Cross-listed Course(s): MEGR 8184. Prerequisite(s): MEGR 7183. Continuation of MEGR 7183. Application of principles, methodology, and analysis to specific design problems. Management of design. Students design machine components, subsystems or whole instruments either individually or as members of design teams. Critical design reviews are conducted. Designs are quantitatively analyzed for conformance to design specifications and intent. Credit will not be awarded for MEGR 7184 where credit has been awarded for MEGR 8184.

MEGR 7185. Gear Manufacturing and Metrology. (3) Cross-listed Course(s): MEGR 8185. Prerequisite(s): MEGR 6181. Fundamentals of manufacturing techniques (e.g., turning, milling, grinding, honing), including the corresponding tools and machine tools. Fundamental knowledge about design, machine components, and tolerances. Introduces the basic knowledge about metrology and standards, statistics, measurement uncertainty, calibration; measurement of geometric quantities (size, form, surface texture). Mathematics, namely elementary vector analysis, approximation algorithms are studied.

MEGR 7186. Data Analysis and Uncertainty. (3) Cross-listed Course(s): MEGR 8186. Intended for graduate students from science and engineering disciplines, with a focus on optical engineering and mechanical engineering. Introduces the principles of measurement uncertainty assessment, uncertainty analysis methodologies, and data analysis/reduction techniques. Topics include: terminology and basic theory of measurement uncertainty, techniques for assessing uncertainty sources, and basic data analysis and data reduction strategies to include fit parameter uncertainty assessment. A major component of the course is a class project where each student applies the methods learned to a measurement relevant to their thesis or dissertation research project where possible.

MEGR 7187. Flexures. (3) Cross-listed Course(s): MEGR 8187. Compliance terms and stresses in leaf and notch type flexures. Rotationally symmetric flexures. Application of Rayleigh's method to estimate resonant frequencies of simple structural elements. Dynamics, design, and manufacture of flexure mechanisms.

MEGR 7191. Introduction to Optical Fabrication and Testing. (3) Cross-listed Course(s): MEGR 8191. Prerequisite(s): PHYS 4271, PHYS 5271, OPTI 6102, OPTI 8102 with grade of C or above, or permission of instructor. Optical elements and their application; optical materials and materials specifications (homogeneity, striae, birefringence), specifications for optical elements(figure, mid-spatial frequencies, finish), optical darwings (ISO 10110), coatings, fabrication methods for flats and spheres, aspheric fabrication, small tool and computer controlled

polishing, interferometric measurement of form and finish, other test methods.

MEGR 7213. Introduction to Computational Fluid Dynamics. (3) Cross-listed Course(s): MEGR 8213. Prerequisite(s): MATH 6171 and knowledge of a scientific programming language. Introductory topics in Computational Fluid Dynamics, including mathematical properties of governing equations, fundamentals of discretization, finite difference and finite volume methods, turbulence modeling, and grid generation.

MEGR 7214. Turbulent Shear Flows. (3) Cross-listed Course(s): MEGR 8214. Prerequisite(s): MEGR 7114. Most of the flows of engineering importance are turbulent flows. This course provides students with the insight required to analyze, investigate, and explain turbulent fluid flows. Topics include: dimensional analysis, the Reynolds equations, elements of the kinetic theory of gases, estimates of the Reynolds Stress, dynamics of turbulence, boundary free shear flows, and wall-bounded shear flows.

MEGR 7215. Turbulence Modeling and Simulations. (3) Cross-listed Course(s): MEGR 8215. Prerequisite(s): MEGR 7214 and permission of instructor. Comprehensive overview of turbulence modeling and simulations. Introduction to the mathematical framework needed to understand turbulence model formulations. Basic principles of turbulence modeling and the limitations of the commonly used modeling approaches, and analysis of turbulent flows using single-point closure modeling.

MEGR 7221. Vibration of Discrete and Continuous Systems. (3) Cross-listed Course(s): MEGR 8221. Topics include: single degree of freedom free and forced vibrations; two degree of freedom free and forced vibration; modal analysis; measurement methods; continuous beam modeling; and receptance coupling.

MEGR 7222. Mechatronics. (3) Cross-listed Course(s): MEGR 8222. Prerequisite(s): Permission of department, workshop badge, ability to solder and debug electrical circuits, introductory level controls. An approach aiming at the synergistic integration of mechanics, electronics, control theory, and computer science within product design and manufacturing, in order to improve and/or optimize its functionality.

MEGR 7223. Mathematical Concepts for Dynamics and Control. (3) Cross-listed Course(s): MEGR 8223. Surveys aspects of abstract linear algebra and functional analysis that commonly arise in the formulation and study of problems in dynamics and control. Students are expected to be familiar with basic calculus and ordinary differential equations.

MEGR 7224. Analytical Mechanics. (3) Cross-listed Course(s): MEGR 8224. Surveys foundations of classical mechanics with an emphasis on Lagrangian and Hamiltonian formalism, including an introduction to underlying concepts from differential geometry. Students are expected to be familiar with linear vector spaces and multivariable calculus.

MEGR 7281. Theory and Application of Computer-Aided Tolerancing. (3) Cross-listed Course(s): MEGR 8281. Prerequisite(s): permission of department. Theory of geometric tolerance representation, analysis, and synthesis. Applications of geometric tolerances for design function and efficient metrology. Laboratory experience with mechanical design and tolerance analysis software. Implementation projects for tolerance analysis and synthesis. Credit will not be awarded for MEGR 7281 where credit has been awarded for MEGR 8281.

MEGR 7282. Computer-Aided Process Planning. (3) Cross-listed Course(s): MEGR 8282. Prerequisite(s): permission of department. Theory and computing methods for the specification, manufacture, and verification of manufactured artifacts with a particular emphasis on precision engineering applications. Representation of engineering designs. Feature recognition. Generation of manufacturing and metrology instructions. Computer software implementation projects. Credit will not be awarded for MEGR 7282 where credit has been awarded for MEGR 8282.

MEGR 7283. Advanced Coordinate Metrology. (3) Cross-listed Course(s): MEGR 8283. Prerequisite(s): MEGR 6181 or permission of department. Error compensation of coordinate measuring machines, algorithms and sampling methods used in data analysis. Probing systems, compensation of probing errors. Scanning coordinate measuring machines and their dynamic behavior. Performance testing of coordinate measuring machines. Credit will not be awarded for MEGR 7283 where credit has been awarded for MEGR 8283.

MEGR 7284. Advanced Surface Metrology. (3) Cross-listed Course(s): MEGR 8284, OPTI 6384, and OPTI 8384. Prerequisite(s): MEGR 6181 or permission of department. Constituents of surface texture, stylus, optical, atomic force microscope and other advanced methods of measuring surface texture. Two and three dimensional measurement of surfaces. Separation of form, waviness and roughness. Random process analysis techniques, use of transforms for filtering. Numerical evaluation of surface texture. Use of surface texture as fingerprint of the process. Relationship between function and surface texture. Credit will not be awarded for MEGR 7284 where credit has been awarded for MEGR 8284.

MEGR 7380. Tribology. (3) Cross-listed Course(s): MEGR 8380. Prerequisite(s): permission of department. Surface properties and study of surfaces in contact. Friction and wear of materials. Tribological properties of solid materials. Fluid lubricated journal bearings, lubrication of highly loaded contacts, lubricating systems and bearing selection. Credit will not be awarded for MEGR 7380 where credit has been awarded for MEGR 8380.

MEGR 7480. Advanced Manufacturing Processes and Equipment. (3) Cross-listed Course(s): MEGR 8480. Prerequisite(s): permission of department. Detailed analytical treatment of manufacturing materials and processes. Forming processes (forging, extrusion, rolling, drawing, bending, shearing), casting processes, metal cutting processes (turning, boring, drilling, shaping, milling), tool materials, joining processes, automation. Credit will not be awarded for MEGR 7480 where credit has been awarded for MEGR 8480.

MEGR 7892. Individual Study and Projects. (1 to 6) Cross-listed Course(s): MEGR 8892. Individual investigation and exposition of results. *May be repeated for credit.*

MEGR 7893. Advanced Topics in Precision Engineering. (3) Cross-listed Course(s): MEGR 8893. Prerequisite(s): permission of department. Topics include: precision control, materials for precision engineering, precision manufacturing, precision measurement, advanced analytical and numerical methods used in precision engineering. *May be repeated for credit with change of topic and permission of department.*

MEGR 7955. Graduate Design I. (3) First of a two-semester sequence leading to a major integrative experience in applying the principles of design and project management to the design of a major mechanical engineering system. Teamwork and communication skills are emphasized.

MEGR 7956. Graduate Design II. (3) Prerequisite(s): MEGR 7955 with grade of C or above. Second of a two-semester sequence leading to a major integrative experience in applying the principles of design and project management to the design of a major mechanical engineering system. Teamwork and communication skills are emphasized.

MEGR 7991. Graduate Master Thesis Research. (1 to 6) Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

MEGR 8000. Research Seminar. (1) Presentations on the current research in Mechanical Engineering, Engineering Science, and related fields. Required for all doctoral students in the MEES program. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

MEGR 8090. Special Topics in Mechanical Engineering. (3) Directed study of current topics of special interest for Ph.D. degree. *May be repeated for credit.*

MEGR 8101. Transport Processes. (3) Cross-listed Course(s): MEGR 7101. Prerequisite(s): permission of department. Unified field theory approach to the fluid transport of momentum, energy, mass and electrical charge. Statistical theories of turbulence and molecular transport. Multiphase systems, chemically reacting flows, ionized fluids, separation processes. Credit will not be awarded for MEGR 8101 where credit has been awarded for MEGR 7101.

MEGR 8102. Introduction to Continua. (3) Cross-listed Course(s): MEGR 7102. Prerequisite(s): MEGR 2144, MEGR 3114, or permission of department. A unified treatment of those topics which are common to all continua. Stress, deformation and velocity fields, constitutive equations and field equations. Representative applications in solid, fluid and electromagnetic continua, including interaction problems. Credit will not be awarded for MEGR 8102 where credit has been awarded for MEGR 7102.

MEGR 8104. Fabrication of Nanomaterials. (3) Cross-listed Course(s): ECGR 7104 and MEGR 7104. Prerequisite(s): NANO 8101 or permission of instructor. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Credit will not be awarded for MEGR 8104 where credit has been awarded for ECGR 7104 or MEGR 7104.

MEGR 8108. Finite Element Analysis and Applications. (3) Cross-listed Course(s): MEGR 7108. Prerequisite(s): MEGR 6141 and MATH 6171 or permission of department. An introduction to the finite element method and its application to engineering problems. Application of the displacement methods to plane stress, plane strain, plate bending and axisymmetrical bodies. Topics may include but are not limited to: dynamics, heat conduction, and structural mechanics. Credit will not be awarded for MEGR 8108 where credit has been awarded for MEGR 7108.

MEGR 8109. Biotechnology and Bioengineering. (3) Cross-listed Course(s): MEGR 8109. Prerequisite(s): admission to a graduate program or permission of instructor(s). This interdisciplinary course discusses key issues in device design, and heat and mass transport with cell biology, molecular biology, and physiology to introduce students to

technological innovations in biotechnology and bioengineering. Credit will not be awarded for MEGR 8109 where credit has been awarded for MEGR 6109.

MEGR 8110. Advanced Conductive Heat Transfer. (3) Cross-listed Course(s): MEGR 8110. Prerequisite(s): MEGR 3116. Theory of steady and unsteady heat conduction in isotropic and anisotropic media. Treatment of concentrated and distributed heat sources. Application of the finite difference and finite element methods. Credit will not be awarded for MEGR 8110 where credit has been awarded for MEGR 7110.

MEGR 8111. Advanced Engineering Thermodynamics. (3) Cross-listed Course(s): MEGR 7111. Prerequisite(s): MEGR 3112 and MATH 3142. Postulational treatment of the laws of thermodynamics. Equilibrium and maximum entropy postulates. Development of formal relationships and principles for general systems. Applications to chemical, magnetic, electric, and elastic systems. Credit will not be awarded for MEGR 8111 where credit has been awarded for MEGR 7111.

MEGR 8112. Radiative Heat Transfer. (3) Cross-listed Course(s): MEGR 7112. Prerequisite(s): MEGR 3116. Fundamentals of radiation heat transfer, analysis of gray body and wavelength dependent systems; radiation from gases at high temperature, and particulate-laden gases; combined radiation and conduction. Credit will not be awarded for MEGR 8112 where credit has been awarded for MEGR 7112.

MEGR 8113. Dynamics and Thermodynamics of Compressible Flow. (3) Cross-listed Course(s): MEGR 7113. Prerequisite(s): MEGR 3111 and MEGR 3114. Compressible flow equations, isentropic flow, normal shock waves, Fanno and Rayleigh line flows. Nonsteady one dimensional flow. Credit will not be awarded for MEGR 8113 where credit has been awarded for MEGR 7113.

MEGR 8114. Advanced Fluid Mechanics. (3) Cross-listed Course(s): MEGR 7114. Prerequisite(s): MEGR 4112 or permission of department. Unified tensorial-theoretical treatment of the transport of mass, momentum, energy and voracity in fluids. General theorems for inviscid and irrational flows. Viscous effects, boundary layer theory, nonlinear phenomena hydrodynamic instability and turbulence with applications. Credit will not be awarded for MEGR 8114 where credit has been awarded for MEGR 7114.

MEGR 8115. Convective Heat Transfer. (3) Cross-listed Course(s): MEGR 7115. Prerequisite(s): MEGR 3116 and MEGR 4112. Heat and momentum transfer prediction in channel flows and boundary layers. Differential equation methods for fully developed and entry length laminar tube flows. Similarity solution for laminar heat transfer. Superposition methods for non-uniform boundary conditions. Integral equations of the boundary layer, approximate and semiempirical methods of solution. Credit will not be awarded for MEGR 8115 where credit has been awarded for MEGR 7115.

MEGR 8116. Fundamentals of Heat Transfer and Fluid Flow. (3) Cross-listed Course(s): MEGR 6116. Prerequisite(s): MEGR 3114 or permission of department. A unified treatment of transfer operations developed in terms of physical rate processes; formulation and solution of typical boundary value problems associated with heat, mass and momentum transfer. Credit will not be awarded for MEGR 8116 where credit has been awarded for MEGR 6116.

MEGR 8117. Statistical Thermodynamics. (3) Cross-listed Course(s): MEGR 7117. Quantum mechanics-based statistical mechanics. Equilibrium macroscopic and microscopic thermodynamic states. Ensemble theory, including classical phase spaces, Liouville theorem, quantum modifications, and Gibbs microcanonical, canonical, and grand canonical ensembles. Introduction to quantum mechanics, including Hamiltonian systems, the density matrix, and quantum statistics. Theory of ideal quantum gases and non-interacting Boson and Fermi-Dirac systems.

MEGR 8118. Thermal Environmental Engineering. (3) Cross-listed Course(s): MEGR 7118. Prerequisite(s): MEGR 3116. Application of the thermodynamic and heat transfer principles to the analysis of thermal environmental systems. Topics include: thermodynamic properties of moist air, psychometric charts, transfer processes, heating and cooling of moist air coils, physiological effects of thermal environments, food processing and storage. Credit will not be awarded for MEGR 8118 where credit has been awarded for MEGR 7118.

MEGR 8119. Thermal Applications in Biomedical Engineering. (3) Cross-listed Course(s): MEGR 7119. Prerequisite(s): permission of department. Application of thermodynamic and heat transfer principles to the analysis of biomedical systems. Topics include: thermodynamic and transport properties of biological tissue, thermoregulation, design and use of cryosurgical probes, and numerical modeling methods. Credit will not be awarded for MEGR 8119 where credit has been awarded for MEGR 7119.

MEGR 8120. Bearing Design and Lubrication. (3) Cross-listed Course(s): MEGR 7120. Prerequisite(s): MEGR 3222 or permission of department. Hydrodynamic lubrication, fluid film and rolling element bearings, design and control of gas and fluid lubricated bearings. Credit will not be awarded for MEGR 8120 where credit has been awarded for MEGR 7120.

MEGR 8121. Mechanism Analysis. (3) Cross-listed Course(s): MEGR 7121. Prerequisite(s): MEGR 3221 or permission of department. Analysis of coplanar and spatial mechanisms, application of matrix methods in analysis of mechanisms, mobility analysis of mechanisms, rigid body guidance, computer-aided analysis of mechanisms. Credit will not be awarded for MEGR 8121 where credit has been awarded for MEGR 7121.

MEGR 8122. Mechanism Synthesis. (3) Cross-listed Course(s): MEGR 7122. Prerequisite(s): MEGR 7121, MEGR 8121, or permission of department. Synthesis of coplanar and spatial mechanisms, number and type synthesis, function generator, path generator, optimal synthesis of mechanisms, case studies in optimal design of mechanisms. Credit will not be awarded for MEGR 8122 where credit has been awarded for MEGR 7122.

MEGR 8123. Mechanical Design. (3) Cross-listed Course(s): MEGR 7123. Prerequisite(s): MEGR 6141 or permission of department. Impact loading on critical sections, fatigue consideration, stress concentration, fluctuating stresses, failure analysis, contact stresses, industrial case studies. Credit will not be awarded for MEGR 8123 where credit has been awarded for MEGR 7123.

MEGR 8124. Introduction to Automatic Controls. (3) Cross-listed Course(s): MEGR 7124. Prerequisite(s): permission of department. Emphasis on mechanical systems. Mathematical models and characteristics of control systems. Performance and stability of linear feedback systems. Root locus and frequency response techniques. State space methods. Design and compensation of control systems. Credit will not be awarded for MEGR 8124 where credit has been awarded for MEGR 7124.

MEGR 8125. Vibrations of Continuous Systems. (3) Cross-listed Course(s): MEGR 6125. Prerequisite(s): MEGR 4143. Analysis of vibration of continuous linear elastic structures such as strings, rods, beams and plates with varying boundary conditions. Approximate solution techniques such as Rayleigh, Rayleigh-Ritz, and Galerkin are presented. Credit will not be awarded for MEGR 8125 where credit has been awarded for MEGR 6125.

MEGR 8126. Dynamics of Machinery. (3) Cross-listed Course(s): MEGR 7126. Prerequisite(s): MEGR 3222 or permission of department. Application of dynamics of machinery, balancing of rigid and flexible rotors. Dynamics of spatial mechanisms. Computer-aided dynamic analysis of machinery. Credit will not be awarded for MEGR 8126 where credit has been awarded for MEGR 7126.

MEGR 8127. Computer-Aided Manufacturing. (3) Cross-listed Course(s): MEGR 7127. Prerequisite(s): MEGR 3255 or permission of department. Topics include: flowline production, numerical control, computer-aided process monitoring and control, group technology, flexible manufacturing, and material requirement planning. Credit will not be awarded for MEGR 8127 where credit has been awarded for MEGR 7127.

MEGR 8128. Control of Robotic Manipulators. (3) Cross-listed Course(s): ECGR 5161 and MEGR 7128. Prerequisite(s): MEGR 4127 or ECGR 4151. Control of industrial robots including linear, nonlinear, and adaptive control of the motion of robots; plus control of forces and torques exerted by the end-effector. Additional topics include computer animation of the controlled behavior of industrial robots, actuators and sensors, robot vision and artificial intelligence, and control computer/robot interfacing. Credit will not be awarded for MEGR 8128 where credit has been awarded for MEGR 7128.

MEGR 8129. Structural Dynamics of Production Machinery. (3) Cross-listed Course(s): MEGR 7129. Prerequisite(s): permission of department. The analytical study of dynamic characteristics of production machinery and the corresponding measurement, specification, and effects on machine performance. Machine tool vibration, machine tool stability, high speed machining. Credit will not be awarded for MEGR 8129 where credit has been awarded for MEGR 7129.

MEGR 8130. Introduction to Control Systems (3) Cross-listed Course(s): MEGR 7130. Introduction to key principles behind feedback control, including closed-loop time domain and frequency domain analysis, root locus design, state feedback, robustness margins, and loop shaping.

MEGR 8131. Automotive Power Plants. (3) Cross-listed Course(s): MEGR 7131. Energy analysis of internal and external combustion engines for vehicular propulsion. Thermodynamic principles for combustion efficient use of fuel combustion, different types of fuel use, and pollutant control.

MEGR 8132. Advanced Automotive Power Plants. (3) Cross-listed Course(s): MEGR 7132. Prerequisite(s): MEGR 7131 or MEGR 8131. Follow-up course to Automotive Power Plants. Topics include: combustion, thermodynamic efficiency, fuel efficiency, torque and power, emissions, etc.

MEGR 8133. Applied Vehicle Aerodynamics. (3) Cross-listed Course(s): MEGR 7133. Prerequisite(s): Foundational knowledge of fluid mechanics and numerical methods in engineering applications. Flow of air around streamlined and bluff bodies, aerodynamic forces, understanding flow separation and reattachments, aerodynamic tools, introduction to computational fluid dynamics, use of commercial CFD packages to solve fluid flow problems,

computer simulation and analysis of flow around bluff bodies and road vehicles including racecars.

MEGR 8134. Advanced Road Vehicle Dynamics. (3) Cross-listed Course(s): MEGR 7134. Prerequisite(s): MEGR 3121, MEGR 3122, and MATH 2171. Advanced topics related to vehicle dynamics and modeling. Acceleration and braking performance, road loads, steady-state cornering, suspension, steering system, and tire behavior are explored.

MEGR 8135. Advanced Tire Mechanics. (3) Cross-listed Course(s): MEGR 7135. Prerequisite(s): MEGR 2144 and MEGR 3121 with grades of C or above. In-depth analysis of the tire and its influence on vehicle performance, including: design, materials, construction, structural response, rolling resistance, force and moment generation, NVH, wet and dry traction, wear, high speed limit, and standards. Tire models, their limitations, and their governing equations. Graduate students develop an experiment (in addition to a literature review), gather data, submit an abstract to the Fall Tire Society Conference, and write a rough draft of a paper.

MEGR 8136. Automotive Materials. (3) Cross-listed Course(s): MEGR 7136. A broad range of automotive materials from steel, aluminum to new materials, such as composite materials. During the class, students are tutored to understand how the industry selects, designs, manufactures, and applies materials for automobiles in general, and what are current applications of various available materials in the automotive industry. Emphasis on structural materials where crashworthiness and structural integrity are important. Basic understanding of mechanics of materials; e.g., Introduction of Solid Mechanics, Introduction of Material Engineering, Mechanics of Materials.

MEGR 8141. Theory of Elasticity I. (3) Cross-listed Course(s): MEGR 6141. Prerequisite(s): MEGR 3221 or permission of department. Introduction to the theory of elastic media; the fundamentals of stress, strain, stress-strain relationships, compatibility and equilibrium. Applications to two- and three-dimensional problems. Structural mechanics and energy methods. Credit will not be awarded for MEGR 8141 where credit has been awarded for MEGR 6141.

MEGR 8142. Theory of Elasticity II. (3) Cross-listed Course(s): MEGR 7142. Prerequisite(s): MEGR 6141 and MATH 6172. Continuation of MEGR 8141 with additional topics in three-dimensional analyses. Topics include: complex variable techniques, variational methods and numerical techniques. Credit will not be awarded for MEGR 8142 where credit has been awarded for MEGR 7142.

MEGR 8143. Inelastic Behavior of Materials. (3) Cross-listed Course(s): MEGR 7143. Prerequisite(s): MEGR 8141 or permission of department. Introduction to plasticity and linear viscoelasticity. Topics include: a study of yield criteria, plastic stress-strain relations, plastic hinge analysis, discrete viscoelastic models, the hereditary integral and selected boundary value problems. Credit will not be awarded for MEGR 8143 where credit has been awarded for MEGR 7143.

MEGR 8145. Advanced Topics in Dynamics. (3) Cross-listed Course(s): MEGR 7145. Prerequisite(s): permission of department. Selected advanced topics in dynamics such as Lagrangian dynamics, vibrations of continuous media, stress wave propagation, and motion measurement. Credit will not be awarded for MEGR 8145 where credit has been awarded for MEGR 7145.

MEGR 8146. Experimental Stress Analysis. (3) Cross-listed Course(s): MEGR 7146. Prerequisite(s): MEGR 8141 or permission of department. Theoretical and experimental techniques of stress and strain analysis, with experimental emphasis on strain gages and instrumentation. Brittle coatings and photoelasticity are also considered. Two lectures and a two-hour lab per week. Credit will not be awarded for MEGR 8146 where credit has been awarded for MEGR 7146.

MEGR 8147. Flight Dynamics. (3) Cross-listed Course(s): MEGR 7147. Prerequisite(s): MEGR 3122 with a grade of B or above. Introduction to key principles behind steady and unsteady flight regimes. Specifically, steady level, ascending, and crosswind flight, along with the corresponding flight envelopes. Full six degree-of-freedom equations of motion are derived for fixed-wing aircraft and aircraft with spinning rotors. Longitudinal and lateral flight modes are analyzed based on the linearized dynamic equations.

MEGR 8148. Stability and Control of Nonlinear Systems. (3) Cross-listed Course(s): MEGR 7148. Prerequisite(s): Graduate standing and knowledge of linear systems theory/linear control design. Introduction to key principles behind the stability and control of nonlinear systems, including internal and external stability, Lyapunov-based stability analysis, analysis of limit cycle behavior, orbital/set stability, linearization-based control, feedback linearization, and periodic control.

MEGR 8151. Orthopedic Biomechanics. (3) Cross-listed Course(s): MEGR 7151. Prerequisite(s): Permission of instructor. Introduces mechanical properties of the human body's hard tissues (bone and cartilage) and soft tissues (ligament and tendon). Focus is placed on mechanical and biological considerations for treatment of orthopedic diseases and sports injuries, such as fracture, ACL injury, and osteoarthritis. Students learn how to solve medical

problems using their engineering knowledge and skills, such as finite element analysis and inverse dynamics.

MEGR 8152. Mechanics of the Human Locomotor System. (3) Cross-listed Course(s): MEGR 7152. Prerequisite(s): Permission of instructor. Introduces dynamic analysis of the human musculoskeletal system. Students learn to develop 3-D rigid body models of human movement, calculate internal forces in muscles and joints during daily and sports activities, and how to use motion capture system and simulation software of human locomotion.

MEGR 8161. Atomic Processes in Solids. (3) Cross-listed Course(s): MEGR 7161. Prerequisite(s): MEGR 2144 or permission of department. Processes dependent on large- and small-scale atomic motions leading to changes in material structures and properties. Theories of diffusion controlled and diffusionless transformations. Modern concepts in structure and property control. Credit will not be awarded for MEGR 8161 where credit has been awarded for MEGR 7161.

MEGR 8163. Materials Characterization and Analysis. (3) Cross-listed Course(s): MEGR 7163. Designed for graduate students to gain an in-depth understanding of principal methods in materials characterization and analysis. Students learn different techniques of materials characterization and analysis, including: (1) structure identification using electron and X-ray diffractions, (2) morphology study using electron microscopy, (3) composition and chemical state determination using electron spectroscopy and other techniques. Focuses on fundamental concepts of different methods, as well as hands-on experience. Well-designed lab sessions are provided for students to practice selected techniques using different instruments (e.g., XRD, SEM, EDS, and sputtering coating).

MEGR 8164. Diffraction/Spectroscopic Studies of Matter. (3) Cross-listed Course(s): MEGR 7164. Prerequisite(s): permission of department. Atomic arrangements in crystalline and non-crystalline forms of matter. Symmetry properties of crystals. Treatment of diffraction theory and experimental methods. X-ray diffraction and spectroscopic analysis of matter. Credit will not be awarded for MEGR 8164 where credit has been awarded for MEGR 7164.

MEGR 8165. Diffraction and NDE Methods in Materials Science. (3) Cross-listed Course(s): MEGR 7165. Prerequisite(s): MEGR 3161 or equivalent or permission of department. Principles of diffraction and non-destructive evaluation methods and their applications to material problems; characterization of atomic and microstructural features and process induced defects in materials; evaluation of residual stress and texture effects; phase and elemental analysis; experimental methodologies. Credit will not be awarded for MEGR 8165 where credit has been awarded for MEGR 7165.

MEGR 8166. Mechanical Behavior of Materials I. (3) Cross-listed Course(s): MEGR 6166. Prerequisite(s): MEGR 3161 or equivalent or permission of department. Macroscopic and microscopic aspects of elastic and plastic deformation and fracture of engineering materials; applications of dislocation theory to an interpretation and control of mechanical properties; temperature, strain rate and texture effects. Credit will not be awarded for MEGR 8166 where credit has been awarded for MEGR 6166.

MEGR 8167. Mechanical Behavior of Materials II. (3) Cross-listed Course(s): MEGR 7167. Prerequisite(s): MEGR 6166 or equivalent. Continuation of MEGR 8166. Topics include: further treatments of dislocation theory and its applications; analysis of fatigue and creep phenomena; strength of polymers and composites; statistical treatment of strength; materials design and failure analysis. Credit will not be awarded for MEGR 8167 where credit has been awarded for MEGR 6167.

MEGR 8168. Deformation and Fracture of Materials. (3) Cross-listed Course(s): MEGR 7166. Prerequisite(s): permission of department. Macroscopic and microscopic aspects of elastic and plastic deformation and fracture; applications of dislocation theory to an interpretation and control of mechanical properties; temperature, strain rate and texture effects. Credit will not be awarded for MEGR 8168 where credit has been awarded for MEGR 7166.

MEGR 8169. Introduction to Transmission Electron Microscopy. (3) Cross-listed Course(s): MEGR 7169. Designed for graduate students with various academic backgrounds, including engineering, nanoscale science, physics, chemistry, and biology. Introduces the theoretical and practical concepts of transmission electron microscopy (TEM). Topics include: basic instrumentation of TEM, diffraction, imaging, and microanalysis. In addition to classroom lectures, students have opportunities to gain hands-on experience of operating a state-of-the-art TEM system and several sample preparation tools. The course consists of weekly lectures and weekly lab sections. The final grade is determined based on homework, lab reports, and examinations.

MEGR 8172. Computational Methods in Engineering. (3) Cross-listed Course(s): MEGR 7172. Numerical linear algebra, solution of systems of equations, numerical integration, differentiation and interpolation, root finding, numerical solution of partial differential equations by finite difference and finite element methods. Credit will not be awarded for MEGR 8172 where credit has been awarded for MEGR 7172.

MEGR 8173. Engineering Design Optimization. (3) Cross-listed Course(s): MEGR 7173. Prerequisite(s): Permission of instructor and programming knowledge in C, C++, FORTRAN, or Matlab. Concepts of optimization and associated terminology. Proper optimization formulation and application in engineering design. Methods for simulation-based optimization with approximation techniques. Credit will not be awarded for MEGR 7173 where credit has been awarded for MEGR 8173.

MEGR 8174. Engineering Analysis I. (3) Cross-listed Course(s): MEGR 7174. An overview of Ordinary Differential Equations, Partial Differential Equations, Fourier series, and Laplace Transforms.

MEGR 8175. Engineering Analysis II. (3) Cross-listed Course(s): MEGR 7175. An overview of Linear Algebra, including Matrix-Matrix operations, types of matrices, Gaussian Elimination, Rank of a Matrix, Eigenvalues and Eigenvectors, Singular Value Decomposition, Approximations of Functions with Fourier Series, Discrete Fourier Transform, Hankel Transform, Orthogonal Polynomials.

MEGR 8181. Engineering Metrology. (3) Cross-listed Course(s): MEGR 6181, OPTI 6381, and OPTI 8381. Prerequisite(s): MEGR 3282 or equivalent. Introduction to metrology and standards. Uncertainty, precision and accuracy in metrology. Measurement of size and form, computational methods in measurement of form. Measurement of surface texture and out of roundness. Machine tool and robot accuracy and calibration. Evaluation of screw threads and gears. Introduction to design of precision instruments. Credit will not be awarded for MEGR 8181 where credit has been awarded for MEGR 6181.

MEGR 8182. Machine Tool Metrology. (3) Cross-listed Course(s): MEGR 7182. Prerequisite(s): MEGR 2180, MEGR 3281, and MEGR 6181. Machine tool accuracy and performance testing. Modeling and measurement of volumetric accuracy using parametric error separation and quasi-static error models. Use of homogeneous transformations for error mapping. Linear and higher order thermal models. Error budgeting and management. Axis of rotation metrology, spindle accuracy, and cutting performance tests. Laboratory experience on CNC machine tools using heterodyne laser interferometers, capacitance gages, and other computer assisted sensor systems for machine checking. Credit will not be awarded for MEGR 8182 where credit has been awarded for MEGR 7182.

MEGR 8183. Design of Precision Machines and Instrument I. (3) Cross-listed Course(s): MEGR 7183. Prerequisite(s): MEGR 3221 and MEGR 8182. Basic patterns in the design of precision machines and instruments. Design process, error assessment and examples, materials, sensors, drives, and controls for precision machines. Machine frames, sliding and rolling element bearings, flexures, hydrostatic bearings. Design methodology, analysis of potential design, design case studies, and modeling of design alternatives. Credit will not be awarded for MEGR 8183 where credit has been awarded for MEGR 7183.

MEGR 8184. Design of Precision Machines and Instrument II. (3) Cross-listed Course(s): MEGR 7184. Prerequisite(s): MEGR 8183. Continuation of MEGR 8183. Application of principles, methodology, and analysis to specific design problems. Management of design. Students design machine components, subsystems or whole instruments either individually or as members of design teams. Critical design reviews are conducted. Designs are quantitatively analyzed for conformance to design specifications and intent. Credit will not be awarded for MEGR 8184 where credit has been awarded for MEGR 7184.

MEGR 8185. Gear Manufacturing and Metrology. (3) Cross-listed Course(s): MEGR 7185. Prerequisite(s): MEGR 8181. Fundamentals of manufacturing techniques (e.g., turning, milling, grinding, honing), including the corresponding tools and machine tools. Fundamental knowledge about design, machine components, and tolerances. Introduces the basic knowledge about metrology and standards, statistics, measurement uncertainty, calibration; measurement of geometric quantities (size, form, surface texture). Mathematics, namely elementary vector analysis, approximation algorithms are studied.

MEGR 8186. Data Analysis and Uncertainty. (3) Cross-listed Course(s): MEGR 7186. Intended for graduate students from science and engineering disciplines, with a focus on optical engineering and mechanical engineering. Introduces the principles of measurement uncertainty assessment, uncertainty analysis methodologies, and data analysis/reduction techniques. Topics include: terminology and basic theory of measurement uncertainty, techniques for assessing uncertainty sources, and basic data analysis and data reduction strategies to include fit parameter uncertainty assessment. A major component of the course is a class project where each student applies the methods learned to a measurement relevant to their thesis or dissertation research project where possible.

MEGR 8187. Flexures. (3) Cross-listed Course(s): MEGR 7187. Compliance terms and stresses in leaf and notch type flexures. Rotationally symmetric flexures. Application of Rayleigh's method to estimate resonant frequencies of simple structural elements. Dynamics, design, and manufacture of flexure mechanisms.

MEGR 8191. Introduction to Optical Fabrication and Testing. (3) Cross-listed Course(s): MEGR 7191.

Prerequisite(s): PHYS 4271, PHYS 5271, OPTI 6102, OPTI 8102 with grade of C or above, or permission of instructor. Optical elements and their application; optical materials and materials specifications (homogeneity, striae, birefringence), specifications for optical elements(figure, mid-spatial frequencies, finish), optical darwings (ISO 10110), coatings, fabrication methods for flats and spheres, aspheric fabrication, small tool and computer controlled polishing, interferometric measurement of form and finish, other test methods.

MEGR 8213. Introduction to Computational Fluid Dynamics. (3) Cross-listed Course(s): MEGR 7213. Prerequisite(s): MATH 6171 and knowledge of a scientific programming language. Introductory topics in Computational Fluid Dynamics, including mathematical properties of governing equations, fundamentals of discretization, finite difference and finite volume methods, turbulence modeling, and grid generation.

MEGR 8214. Turbulent Shear Flows. (3) Cross-listed Course(s): MEGR 7214. Prerequisite(s): MEGR 7114 or MEGR 8114. Most of the flows of engineering importance are turbulent flows. This course provides students with the insight required to analyze, investigate, and explain turbulent fluid flows. Topics include: dimensional analysis, the Reynolds equations, elements of the kinetic theory of gases, estimates of the Reynolds Stress, dynamics of turbulence, boundary free shear flows, and wall-bounded shear flows.

MEGR 8215. Turbulence Modeling and Simulations. (3) Cross-listed Course(s): MEGR 7215. Prerequisite(s): MEGR 8214 and permission of instructor. Comprehensive overview of turbulence modeling and simulations. Introduction to the mathematical framework needed to understand turbulence model formulations. Basic principles of turbulence modeling and the limitations of the commonly used modeling approaches, and analysis of turbulent flows using single-point closure modeling.

MEGR 8221. Vibration of Discrete and Continuous Systems. (3) Cross-listed Course(s): MEGR 7221. Topics include: single degree of freedom free and forced vibrations; two degree of freedom free and forced vibration; modal analysis; measurement methods; continuous beam modeling; and receptance coupling.

MEGR 8222. Mechatronics. (3) Cross-listed Course(s): MEGR 7222. Prerequisite(s): Permission of department, workshop badge, ability to solder and debug electrical circuits, introductory level controls. An approach aiming at the synergistic integration of mechanics, electronics, control theory, and computer science within product design and manufacturing, in order to improve and/or optimize its functionality.

MEGR 8223. Mathematical Concepts for Dynamics and Control. (3) Cross-listed Course(s): MEGR 7223. Surveys aspects of abstract linear algebra and functional analysis that commonly arise in the formulation and study of problems in dynamics and control. Students are expected to be familiar with basic calculus and ordinary differential equations.

MEGR 8224. Analytical Mechanics. (3) Cross-listed Course(s): MEGR 7224. Surveys foundations of classical mechanics with an emphasis on Lagrangian and Hamiltonian formalism, including an introduction to underlying concepts from differential geometry. Students are expected to be familiar with linear vector spaces and multivariable calculus.

MEGR 8281. Theory and Application of Computer-Aided Tolerancing. (3) Cross-listed Course(s): MEGR 7281. Prerequisite(s): permission of department. Theory of geometric tolerance representation, analysis, and synthesis. Applications of geometric tolerances for design function and efficient metrology. Laboratory experience with mechanical design and tolerance analysis software. Implementation projects for tolerance analysis and synthesis. Credit will not be awarded for MEGR 8281 where credit has been awarded for MEGR 7281.

MEGR 8282. Computer-Aided Process Planning. (3) Cross-listed Course(s): MEGR 7282. Prerequisite(s): permission of department. Theory and computing methods for the specification, manufacture, and verification of manufactured artifacts with a particular emphasis on precision engineering applications. Representation of engineering designs. Feature recognition. Generation of manufacturing and metrology instructions. Computer software implementation projects. Credit will not be awarded for MEGR 8282 where credit has been awarded for MEGR 7282.

MEGR 8283. Advanced Coordinate Metrology. (3) Cross-listed Course(s): MEGR 7283. Prerequisite(s): MEGR 6181 or permission of department. Error compensation of coordinate measuring machines, algorithms and sampling methods used in data analysis. Probing systems, compensation of probing errors. Scanning coordinate measuring machines and their dynamic behavior. Performance testing of coordinate measuring machines. Credit will not be awarded for MEGR 8283 where credit has been awarded for MEGR 7283.

MEGR 8284. Advanced Surface Metrology. (3) Cross-listed Course(s): MEGR 7284, OPTI 6384, and OPTI 8384. Prerequisite(s): MEGR 6181 or permission of department. Constituents of surface texture, stylus, optical, atomic force microscope and other advanced methods of measuring surface texture. Two and three dimensional measurement of surfaces. Separation of form, waviness

and roughness. Random process analysis techniques, use of transforms for filtering. Numerical evaluation of surface texture. Use of surface texture as fingerprint of the process. Relationship between function and surface texture. Credit will not be awarded for MEGR 8284 where credit has been awarded for MEGR 7284.

MEGR 8380. Tribology. (3) Cross-listed Course(s): MEGR 7380. Prerequisite(s): permission of department. Surface properties and study of surfaces in contact. Friction and wear of materials. Tribological properties of solid materials. Fluid lubricated journal bearings, lubrication of highly loaded contacts, lubricating systems and bearing selection. Credit will not be awarded for MEGR 8380 where credit has been awarded for MEGR 7380.

MEGR 8480. Advanced Manufacturing Processes and Equipment. (3) Cross-listed Course(s): MEGR 7480. Prerequisite(s): permission of department. Detailed analytical treatment of manufacturing materials and processes. Forming processes (forging, extrusion, rolling, drawing, bending, shearing), casting processes, metal cutting processes (turning, boring, drilling, shaping, milling), tool materials, joining processes, automation. Credit will not be awarded for MEGR 8480 where credit has been awarded for MEGR 7480.

MEGR 8892. Individual Study and Projects. (1 to 6) Cross-listed Course(s): MEGR 7892. Individual investigation and exposition of results. *May be repeated for credit.*

MEGR 8893. Advanced Topics in Precision Engineering. (3) Cross-listed Course(s): MEGR 7893. Prerequisite(s): permission of department. Topics include: precision control, materials for precision engineering, precision manufacturing, precision measurement, advanced analytical and numerical methods used in precision engineering. *May be repeated for credit with change of topic and permission of department.* Credit will not be awarded for MEGR 8893 where credit has been awarded for MEGR 7893.

MEGR 8990. Industrial Internship. (1 to 3) Cross-listed Course(s): MEGR 6990. Prerequisite(s): Completion of nine hours of graduate coursework. Full- or part-time academic year internship in engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by their graduate program director. Requires a mid-term report and final report to be graded by the supervising faculty.

MEGR 8999. Doctoral Dissertation Research. (1 to 9) Individual investigation culminating in the preparation and presentation of a doctoral dissertation. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Fire Protection and Safety Management (MFPA)

MFPA 5123. Human Behavior in Fire. (3) Prerequisite(s): ETFS 3103 and ETFS 3113, or permission of department. Individual decision processes and behavior, modeling of people movement, calculation methods for egress prediction, egress design, and fire safety signs and alarm systems.

MFPA 5132. Fire and Building Codes, Standards, and Practices. (3) Prerequisite(s): ETFS 3103 or permission of department. History of fire safety regulation development; building fire characteristics, fire test methods, and fire safety of buildings and structures; contemporary building and fire codes, practices, and their enforcement.

MFPA 5144. Fire Protection Systems. (3) Prerequisite(s): ETFS 3103, ETFS 3113, or permission of department. An advanced study of various fire protection systems in regard to contemporary fire and life safety problems. Topics include: process of fire and smoke development, principles of active fire suppression and detection systems, hydraulics, automatic sprinkler systems, passive fire protection systems, structural fire resistance, installation and maintenance of fire protection systems.

MFPA 5150. Human Resources Management in Emergency Services. (3) Cross-listed Course(s): MPAD 6134. Prerequisite(s): permission of department. A study of the context of public personnel fire/emergency services related administration; basic functions of job evaluation and compensation, employee rights and responsibilities; the legal constraints including equal opportunity, health and safety, collective bargaining; government productivity.

MFPA 5223. Industrial Safety and Facilities Management. (3) Prerequisite(s): ETFS 3123 or permission of department. Investigation and analysis of hazard control principles relating to the management of personnel, facilities, and equipment, including control procedures, work-task analysis, risk identification and countermeasures, safety training, and pertinent safety management techniques.

MFPA 6000. Special Topics in Fire Protection and Safety Management. (3) Prerequisite(s): Permission of department. Examination of specific new and emerging areas in the fields of fire protection and safety management. *May be repeated for credit.*

MFPA 6103. Fire Dynamics. (3) Prerequisite(s): ETME 3143 and ETME 3244, or permission from the department.

Introduces students to fundamentals of fire and combustion and is intended to serve as the first exposure to fire dynamics phenomena. Includes fundamental topics in fire and combustion such as thermodynamics of combustion, fire chemistry, premixed and diffusion flames, solid burning, ignition, plumes, heat release rate curves, and flame spread.

MFPA 6113. Fire Failure Analysis. (3) Prerequisite(s): MFPA 6103 or permission of department. Provides knowledge for the development of fire investigation and reconstruction as a basis for determining fire cause and origin and evaluating and improving fire safety design. Accident investigation theory and failure analysis techniques such as fire re-creation testing and modeling are presented.

MFPA 6120. Public and Private Sector Interoperability. (3) Cross-listed Course(s): MPAD 6290. Prerequisite(s): Permission of department. A study of multi-agency interoperability and the effective organization and management of emergency resources at various fire and large-scale emergency incidents. Includes a review of national standards and federal regulations impacting emergency incident management. Case studies of actual and theoretical incidents will be used to reinforce command and control concepts.

MFPA 6124. Fire Service and the Community. (3) Prerequisite(s): Permission of department. Theoretical concepts of public service to build an understanding of how the fire service fits within the community.

MFPA 6126. Arson. (3) Prerequisite(s): Permission of department. Utilizes lecture and case studies of arson fires that were started for various reasons, including financial gain, revenge and to conceal other crimes. The criminal intent and the psychological aspects of the fire setter are discussed.

MFPA 6164. Fire Science Laboratory. (3) Prerequisite(s): MFPA 6103 or permission of department. Instruction and hands-on experience with fire-science-related experimental measurement techniques. The objective is to expose students to laboratory-scale fire experiments, standard fire tests and state-of-the-art measurement techniques.

MFPA 6203. Fire Modeling. (3) Prerequisite(s): MFPA 6103 or permission from the department. Modeling of compartment fire behavior is studied through the use and application of two types of models: zone and field. The zone model studied is CFAST. The field model studied is FDS. Focus on the understanding of each of these models is the primary objective in terms of needed input, interpretation of output and limitations.

MFPA 6232. Structural Fire Safety. (3) Prerequisite(s): ETGR 2102 or ETME 3123, ETME 3244, or permission of department. Provides the knowledge needed for structural fire safety design and analysis. Course topics include design philosophies and methods in fire safety engineering, principles of and approaches for structural design for fire safety, behavior of compartment fires, behavior of structural materials in fire, and structural fire safety of typical materials and their components.

MFPA 6233. Performance-Based Design. (3) Prerequisite(s): ETFS 6203 or permission of department. Practical applications of fire protection engineering principles to the design of buildings. Both compartmented and non-compartmented buildings will be designed for criteria of life safety, property protection, continuity of operations, operational management and cost.

MFPA 6243. Research Investigation. (3) Prerequisite(s): permission of the department. Opportunities in conducting research to tackle fire safety related real-world problems. With guidance from the instructor, students can work individually or as a team on a one-semester project.

MFPA 6244. Fire Detection and Smoke Management. (3) Prerequisite(s): ETFS 3103 or permission of department. Addresses the fundamentals and practices of fire detection and smoke management. Topics include: principles of fire detection, fire alarm technology, and contemporary fire detection and alarm systems; principles applicable to the design and analysis of smoke management systems; factors affecting smoke movement; smoke hazard assessment; airflow in buildings, performance characteristics of smoke control and management systems.

MFPA 6252. Law and Fire Safety. (3) Prerequisite(s): Permission of department. Responding to natural and manufactured building hazards requires a complex legal environment, including regulation and liability. Key topics include the use of model codes, administrative regulation, retrospective codes, federal preemption, arson, performance based codes, risk based regulation, engineering malpractice, product liability and disaster investigation.

MFPA 6255. Leadership/Conflict Management in Public Emergency Services. (3) Cross-listed Course(s): MPAD 6141. Prerequisite(s): Permission of department. The role of the administrator as a focal point in social change and the management of the conflict, which occurs. Perspectives on the negotiation and bargaining process will be reviewed.

MFPA 6260. Organization and Management of Public Fire Protection. (3) Cross-listed Course(s): MPAD 6104. Prerequisite(s): Permission of department. A presentation

of modern management principles and techniques to the organization and delivery of the array of services that communities have come to expect from the fire service. The traditional and evolving roles of the fire service to protection, prevention, risk analysis and community service are also considered.

MFPA 6270. Budgeting, Grants, Contracts and Finance in Emergency Services. (3) Prerequisite(s): Permission of department. Develops the understanding of strategic planning, contracting and budgeting practices as well as grant proposal writing with the emphasis on contract administration skills necessary to operation of a functioning governmental entity.

MFPA 6800. Independent Study. (1 to 3) Prerequisite(s): Permission of department. The MFPA program offers independent study and special study courses to allow students to pursue studies in areas for which there are no approved formal courses. *Graded on a Pass/Unsatisfactory basis.* Special study courses can be taken for a grade if the paperwork indicates it will be taken A/F. Each requires a title, justification, and the method of evaluation. Courses taken for A/F grade may be used to satisfy degree requirements. *May be repeated for credit.*

MFPA 6900. Thesis. (1 to 6) Prerequisite(s): Permission of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

Public Administration (MPAD)

MPAD 6000. Topics for Graduate Study in Public Administration. (1 to 4) Intensive study of a topic in public administration. The topic of investigation may vary from semester to semester. *May be repeated for credit.*

MPAD 6102. Foundations in Public Administration. (3) Pre- or Corequisite(s): POLS 1110 or its equivalent, and admission into MPAD Program. Consideration of the political context of contemporary public administration, with attention to the role of administration in the policy process, the legal basis for public administration, legislative-executive relations, and accountability, ethics, and responsibility in democratic administration.

MPAD 6104. Public Organizations and Management. (3) Pre- or Corequisite(s): Admission into MPAD Program. Changing images of people, organizations and organizational environments; research findings and applications related to organization structure, motivation, leadership, communications, decision-making, group dynamics, interpersonal skills; ethics and values important to the study and practice of organizational leadership; and assessment of value systems and the impact of competing value systems on public and organizational policy making.

MPAD 6125. Research Methods for Public Administrators. (3) Pre- or Corequisite(s): STAT 1222 or its equivalent, and admission into MPAD Program. An introduction to the application of social science research methods to problems in public management and policy. Topics include: research design, measurement, data collection techniques, sampling, and decision-making theory. Includes basic introduction to the manipulation of data sets with statistical software.

MPAD 6126. Data Analysis for Decision Making. (3) Prerequisite(s): STAT 1222 or its equivalent and MPAD 6125; and admission into MPAD Program. Continuation of MPAD 6125 by developing proficiency with an array of statistical procedures and tools for choosing which procedure applies to various decision making situations. Focus is on problem setup, computer-based computations, and outcome interpretation in applied settings.

MPAD 6128. Foundations of Public Policy. (3) An examination of the role of public administrators in the policy process. Topics focus on issue formation, agenda setting, decision making, implementation, and policy evaluation. Course emphasizes the role of political actors and institutional constraints in various policy arenas.

MPAD 6131. Public Budgeting and Finance. (3) Pre- or Corequisite(s): Admission into MPAD Program. An introduction to the basics of public finance and an examination of the theory and development of public budgeting, the budget processes, the budget cycle, budget reforms, capital budgets, revenue sources, taxation policies and processes, intergovernmental fiscal relations and governmental accounting practices, debt management and cash management in public organizations.

MPAD 6134. Human Resources Management. (3) Pre- or Corequisite(s): Admission into MPAD Program. Study of the context of public personnel administration; basic functions of job evaluation and compensation, employee rights and responsibilities; the legal constraints including equal opportunity, health and safety, collective bargaining; government productivity.

MPAD 6141. Conflict Management in Public Organizations. (3) Deals with how to handle conflict within public and nonprofit agencies, as well has between organizations. Students will examine how the "publicness" of government agencies makes conflict management an especially difficult endeavor.

MPAD 6142. Grant Writing and Reporting. (3) Focuses on the life cycle of grants and the researching, writing, managing, and reporting skills necessary to manage grants in public and nonprofit organizations.

MPAD 6143. Introduction to Administrative Law. (3) Prerequisite(s): MPAD 6102 or permission of instructor. Examines the legal principles governing the modern administrative state, including: the Constitutional status of administrative agencies; legislative, judicial, and executive control of administrative agencies; discretion in making, adjudicating, and enforcing law and policy; the Administrative Procedures Act; and judicial review of agency action.

MPAD 6160. Leadership in the Digital Era. (3) Public and nonprofit organizations are increasingly dependent on information technology in the delivery of services. This course examines the organizational challenges and best practices associated with successful information technology outcomes. Specifically, it focuses on the implementation of IT on organizational performance. It exposes the student to many of the challenges of leading organizations in a digital environment.

MPAD 6172. Administration of the Healthcare Systems in the United States. (3) Components of the healthcare system in the United States, with emphasis on the relationships among public (local, state and federal), private, voluntary and nonprofit entities; including points of access for recipients of healthcare; relationships with other human services and professions involved in providing healthcare; and the regulatory environment governing these relationships.

MPAD 6174. Public Policy and Politics in Healthcare Administration. (3) Cross-listed Course(s): HADM 6142. Prerequisite(s): HADM 6100 and MPAD 6172. Examination of the formulation, adoption and implementation of public policy for healthcare through federal, state and local political processes.

MPAD 6184. Urban Government and Politics. (3) Introduces students to urban affairs: the development of urban areas, the structures of local governmental bodies, the actors common to urban political scenes, and the incentives that motivate citizens and city officials. Illustrates urban policy issues such as poverty, race, transportation, housing, public safety, education, economic development, land-use, and service delivery.

MPAD 6185. Intergovernmental Relations. (3) Survey of the complex relationships of governments in an urban environment set in the federal system. A review of the problems created by that system and the approaches to their solutions.

MPAD 6187. Advanced Seminar in Public Management Problem Solving. (3) Prerequisite(s): All core courses in the MPAD Program and approval by the Program Director. Seminar viewed as a capstone to the student's coursework in public management and is required to be taken by all students. Seminar devoted to topics in public management, which involve problem identification and solution.

MPAD 6188. Research Applications in Public Administration. (3) Prerequisite(s): All core courses in the MPAD Program and approval by the Program Director. Preparation of a major paper on a topic of significance in public or nonprofit administration. Topics must be approved by the instructor, and paper drafts will be revised by the student following evaluation by the instructor. Each paper must be well grounded in the appropriate professional literature and must demonstrate competence in professional communication skills.

MPAD 6210. Aging and Public Policy. (3) Cross-listed Course(s): GRNT 6210. Examination of the public policy making process with attention to aging policy. Consideration of determinants of aging policy and institutions and actors in the policy making process and piecemeal development of legislation will be analyzed as factors related to the making of policy for the aged.

MPAD 6211. Administration of Aging Programs. (3) Cross-listed Course(s): GRNT 6211. Focuses on the implementation of public policies and programs for the aged and the development and administration of these programs. Students become familiar with the process through which policies are transformed into aging programs and the budgetary, management and evaluative considerations that must be considered.

MPAD 6290. Emergency Management. (3) Focuses on the principles and practices of emergency management at the local, state, and national levels and will explore the concepts of preparedness, mitigation, response and recovery. Conducted from the perspective of emergency management's impact on local government and infrastructure, and the community's ability to prepare for, respond to, and recover from a wide array of catastrophes.

MPAD 6291. Homeland Security and Terrorism. (3) Investigates the organization and operation of the Department of Homeland Security, with a special emphasis placed on how the department deals with the threat of terrorism. Strategies and tactics for fighting terrorism as well as other threats to homeland security will be examined.

MPAD 6292. Disaster Management. (3) Emergency managers must be prepared to face a wide variety of

natural, technological and public health disasters in their communities. Having a good understanding of a potential disaster's unique characteristics and dynamics can help an emergency manager better prepare for the worst-case scenario. Focuses on a series of natural and weather-related disasters, technological or man-made disasters and public health disasters.

MPAD 6310. Foundation of the Nonprofit Sector. (3) Survey of the history, culture and legal foundation of the nonprofit sector. Key definitions, scope and relationships between the nonprofit, for profit and government sectors are discussed. Examines current policy issues confronting nonprofits.

MPAD 6311. Introduction to Nonprofit Management. (3) Examination of the structure, function and administration of nonprofit organizations. Developing strategies to ensure financial and ethical management.

MPAD 6312. Fundraising. (3) Provides a comprehensive overview of fundraising techniques geared toward various types of nonprofit organizations including education, health, arts and social services. Topics include: Annual giving, major gifts, estate planning, working with corporations and foundations, ethics and legal responsibilities. Students learn to balance organizational needs with donor interests and the vehicles that can accomplish those goals.

MPAD 6314. Marketing for Arts and Nonprofit Organizations. (3) Recognizing the breadth and complexity of cultural organizations, the purpose of this class is to familiarize students with the fundamentals of marketing organizational programs and activities within the visual art field. Students will be given a broad overview of the functional components of administrative management and participation in the theory and techniques of public relations, audience development, market research, advertising and various promotional strategies. They will have the opportunity to explore, discuss and understand the principles of successful marketing for art organizations.

MPAD 6316. Introduction to Arts Administration. (3) Prerequisite(s): MPAD 6311. Introduction to the history and practice of arts administration. Explores the distinctions and challenges common to all areas of the arts and considers the differences in mission and administration among organizations in theatre, dance, music, visual arts, media arts, arts councils and arts service organizations, arts education, and multidisciplinary organizations. Examines regulations and distinctions related to nonprofit status and various new hybrids. Reviews community involvement in the arts at the local, state, regional, and national levels. Shares the cultural and economic contributions of the arts.

MPAD 6318. Arts Administration II. (3) Prerequisite(s): MPAD 6316. Examines the manner in which artists and arts organizations build community and function within and support their communities. Topics include: cultural planning, public art and place-making, public policy, the integration of multiple cultures into arts policy and programs, understanding cultural democracy, and using the arts in the development of community identity.

MPAD 6324. Financial Analysis for Nonprofit Organizations. (3) Topics include: fund accounting basics for nonprofit organizations, preparation and analysis of financial statements, evaluating and monitoring financial condition, capital budgeting and investment analysis, debt policy and management.

MPAD 6326. Applied Economics for Public Administrators. (3) Introduces students to the fundamental concepts of microeconomics in order to enhance their analytical skills to a level that is appropriate for practitioners in the public sector. Focuses on how the market works, why the market results in beneficial exchanges between sellers and buyers, what effects government intervention can have upon the market, whether government intervention is necessary, and how the tools of economics can be used by public administrators to improve decision making.

MPAD 6327. Internal Capacity Building in Nonprofit Organizations. (3) Development of proficiency among an array of internal management tools, including: strategic planning; volunteer recruitment, management, and retention; and program evaluation and performance measurement.

MPAD 6328. Urban and Community Development. (3) Examines the policies and programs designed to reduce social and economic distress in U.S. communities and focuses on local and neighborhood-based efforts to address problems of inadequate housing, unemployment, lack of community services and facilities, crime etc. Considers the various roles that government, private sector, and nonprofit organizations play in community revitalization.

MPAD 6329. Nonprofit Organizations and their Environment. (3) Development of the skills needed to navigate in the complex external environment, including: fundraising, resource development, and donor development; networking, strategic alliances, and public relations; and legal requirements and issues of liability.

MPAD 6330. Program Evaluation for the Public and Nonprofit Sectors. (3) Designed to give students a comprehensive overview of the theory, concepts, methods, and tools of program evaluation. In addition to providing an overview of various types and uses of program evaluation, the course emphasizes building

expertise in evaluation design, developing process and outcome measures, analyzing data, and reporting results. Addresses the use of evaluation tools to support the development and management of programs.

MPAD 6332. Project Management. (3) A project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. This course explores the discipline of project management across the project lifecycle. Based on the Project Management Institute's (PMI) *Project Management Body of Knowledge.* At the completion of the course, students should have the knowledge to successfully complete the PMI's certification exam.

MPAD 6350. Public Sector Financial Management. (3) Prerequisite(s): MPAD 6131. Takes students beyond the introductory material in MPAD 6131 into a more thoroughgoing analysis of the finance function in modern governments. The dimensions of budgeting and financial management theory and practice which are examined include: public sector managerial accounting for revenues and expenditures; basic governmental accounting principles and procedures; the relationship of budgets to the accounting system; principles and concepts of revenue policy and administration. Topics covered are some of the fundamental aspects of public financial management.

MPAD 6352. Public Sector Financial Reporting and Analysis. (3) Prerequisite(s): MPAD 6131. Extending the coverage of public financial management topics to include the accounting and reporting activities of government and nonprofit organizations. The dimensions of accounting and financial management theory and practice which are examined include: accounting for revenues and expenditures; basic governmental accounting principles and procedures, business-type activities of governments, governmental third-party fiduciary activities, agency relationships, the relationship of budgets to the accounting system, financial reporting and auditing, financial statement analysis, and credit analysis. A unit of the course also concerns ethics, risk-taking and accountability, with a special emphasis on high-risk "derivative securities," and the need to maintain the highest standards of fiduciary responsibility.

MPAD 6800. Directed Study in Public Administration. (3) Prerequisite(s): All core courses in the MPAD Program and approval by the Program Director. Individual project proposal on a directed topic of significance based on field experience in public administration. *Graded on a Pass/In Progress basis.*

MPAD 6801. Directed Study in Public Administration. (3) Prerequisite(s): MPAD 6800 and approval by the MPAD Program Director. Individual project report on a directed topic of significance based on field experience in public administration. *Graded on a Pass/In Progress basis.*

MPAD 6820. Independent Study. (1 to 3) Prerequisite(s): Permission of instructor and the MPAD Program Director. Supervised study of a public administration topic or problem of special interest to the student, within the instructor's expertise, and normally an extension of previous coursework with the instructor. *May be repeated for credit with change of topic.*

Management (MSMG)

MSMG 6100. Quantitative Business Analysis. (3) An introduction to the analytical foundations of business decision making. Students learn to identify important issues to be considered when working with data to answer a question. They also learn the basics of analyzing data and making decisions based on the analysis. Topics include: basic statistics through regression analysis.

MSMG 6110. Principles of Financial and Managerial Accounting. (3) Accounting is the language of business. This course teaches students how to interpret financial statements to evaluate the performance and strength of a business. Students also learn how organizations determine the cost of providing goods and services; use accounting data for budgeting and profit planning; and identify strategies for improving the quality of goods and services for customers while increasing efficiency, profitability, and sustainability of the organization.

MSMG 6120. Management and Organizational Behavior. (3) An examination of individual, group, and organizational issues that affect and shape organizations. Topics include: individual differences, motivation, communication, decision-making, leadership, power, organizational structure and design, and change.

MSMG 6130. Economics for Managers. (3) Economics for managers covers the micro- and macroeconomic concepts required to understand the environment in which business firms operate. Topics include: supply and demand, the behavior of firms and consumers, business cycles, exchange rates, and the effects of monetary and fiscal policies.

MSMG 6140. Information Systems Management. (3) Information Systems are an essential tool for conducting business and gaining a competitive edge in an increasingly global economy. This course educates future managers on conceptual foundations underlying the management of

information resources. Students are also exposed to widely used business applications software.

MSMG 6150. Managing Talent for Strategic Advantage. (3) Human resource management plays an important role in creating and sustaining competitive advantage. This course focuses on the manager's role in attracting, developing, and retaining talent in organizations. Contemporary issues such as globalization, outsourcing, workforce diversity, mergers and acquisitions, downsizing, and occupational health, safety, and security are explored in terms of their strategic value.

MSMG 6160. Marketing from a Management Perspective. (3) Since all companies (i.e., both for-profit and non-profit) require some form of selling to be in business, it is incumbent upon managers to have an understanding of marketing processes. This course educates future managers on the psychology and sociology associated with consumer behaviors. Upon completion, students will have the skills needed to make informed and critical decisions required for the company's future profitability.

MSMG 6170. Analysis for Financial Management. (3) The theory and practice of financial management, including financial instruments and markets, financial statement analysis, financial forecasting, cost of capital and capital budgeting, and evaluating investment opportunities. Students learn the methods and techniques for assessing the financial health of a company, planning future financial performance, and creating value for shareholders.

MSMG 6180. Managing Your Organization's Operations. (3) The operations function is an integral part of every organization, and managers must be familiar with issues arising in this area. This course educates future managers on understanding how to manage the provision of goods and services both effectively and efficiently, as well as understanding how to improve related processes.

MSMG 6190. Managerial Ethics and Leadership. (3) An examination of the role and impact of management decisions on employees, customers, investors, and the environment. This capstone course focuses on management and decision-making to facilitate ethical and sustainable organizations.

MSMG 6690. Career/Professional Development Seminar. (0) Prerequisite(s): Permission of Graduate Program Director. Coverage of various career development topics and activities, including self-assessment, personal branding, resume writing, interview skills, leadership and networking, community and corporate speakers and site visits.

Real Estate (MSRE)

MSRE 5110. Foundations of Economics. (3) Cross-listed Course(s): MBAD 5110. Focuses on topics related to the scope and methodology of economics as a social science, the analysis of markets, the development of market structure, the characteristics of market failure, problems of economic concentration, the theory of income distribution, the measurement of national income, the theory of national income determination, money and banking, monetary and fiscal policy, and international economics.

MSRE 5131. Fundamentals of Financial Accounting and Financial Management. (3) Cross-listed Course(s): MBAD 5131. Accelerated and in-depth study of conceptual foundations and applications of financial accounting and financial management with emphasis placed on building accounting and finance information bases for external decision making.

MSRE 6101. Real Estate Seminar. (1) Designed to provide students with exposure to emerging trends in the real estate industry. Students are required to participate in real estate trade organization meetings, engage in leadership and negotiation training, attend guest lecturers covering real estate trends and ethical business practices, and complete professional development seminars. *May be repeated for credit with change of topic.*

MSRE 6102. International Real Estate Study Tour. (3) Students travel to an international city to study real estate development. Opportunities and challenges in the regional real estate market will be explored through the completion of a series of study tours, presentations, reading assignments and short essays. Emphasis will be placed on issues such as urban planning, sustainable growth, economic development and global market integration.

MSRE 6120. Real Estate Law. (1.5) Prerequisite(s): MSRE 5110 and MSRE 5131. Provides an overview of common legal issues involved in the acquisition, development, financing, ownership and operation of real estate assets. Emphasis is placed on legal forms of ownership, real estate sale and lease transactions, and government regulation and taxation of land.

MSRE 6130. Site Planning. (1.5) Introduces essential principles of site planning, design and construction. Special emphasis is placed on programming and sustainability issues for different project types. The nature and characteristics of construction materials, equipment, and systems used in modern buildings are presented and how they affect function and feasibility.

MSRE 6152. Financial Management. (3) Cross-listed Course(s): MBAD 6152 and FINN 6152. Prerequisite(s):

MSRE 5110 and MSRE 5131. Theory and practice of corporate finance including asset management, cost of capital and capital budgeting, optimization programs and socio-economic aspects of financial management. Computer technology may be employed when applicable.

MSRE 6158. Real Estate Finance and Investment. (3) Cross-listed Course(s): MBAD 6158. Prerequisite(s): MSRE 5110 and MSRE 5131. Focuses on the techniques used to analyze, finance and structure real estate transactions. Topics include: an overview of the real estate space and capital markets; the techniques of financial analysis and valuation; project ownership structures, taxation and financial structure; real estate in an investment portfolio; and determining the financial feasibility of real estate development.

MSRE 6159. Real Estate Development. (3) Cross-listed Course(s): GEOG 6103 and MBAD 6159. Prerequisite(s): MSRE 5110 and MSRE 5131. An introduction to the real estate development process. Identification and evaluation of the critical assumptions and issues related to market and site feasibility, financial feasibility, planning, acquisition, and operation of economically viable commercial real estate projects. Students work in groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

MSRE 6160. Real Estate Capital Markets. (3) Cross-listed Course(s): MBAD 6160. Prerequisite(s): MSRE 6152. The techniques used to analyze, finance and structure real estate transactions, and emphasizes the role of the capital markets in facilitating development and investment in commercial real estate. Topics include: real estate in an investment portfolio; valuation and investment analysis for direct (private) real estate equity investment including coverage of valuation using real option methodology; primary and secondary commercial mortgage markets (CMBS); and, analysis of publicly traded equity real estate investment trusts (REITs).

MSRE 6210. Student Managed Real Estate Investment Fund. (3) Focuses on managing an actual real estate portfolio consisting of a portion of the University's Endowment Fund.

MSRE 6220. Financial Analysis of Real Estate Investments. (1.5) Prerequisite(s): MSRE 6158, MSRE 6159, or permission of instructor. Provides students with the analytical and computer skills necessary to evaluate the financial feasibility of real estate investment opportunities, including acquisition and development opportunities for land, commercial, industrial, or multi-family deals. Accounting and taxation issues influencing the financial viability of real estate investment opportunities are also considered.

MSRE 6230. Construction Management. (1.5) Addresses the various roles and responsibilities of the contractor and construction manager in the development process including discussion of the owner/designer/constructor relationship. Emphasis is placed on sustainable design and other public policy objectives advanced by specific types of development, as well as the role the public sector may play in the success of real estate projects.

MSRE 6238. Real Estate and Urban Economics. (3) Prerequisite(s): ECON 2102. Cross-listed Course(s): ECON 6238 and MBAD 6238. Focuses on the fundamental economic forces that create urban areas, with a special emphasis on land markets. Integrates economic theory to better understand the market forces that impact applied real estate development projects. Topics include: urban growth and development; land valuation; the modelling and estimation of agglomeration economies; the costs of cities and their internal structure with emphasis on land use regulations and transportation; amenities and the local supply of labor; the sizes and functions of cities; affordable housing; and local public finance.

MSRE 6240. Real Estate Valuation Methods. (3) Introduction to modern approaches to both land and building valuation, with extensive treatment of the highest and best use concept and applications of discounted cash flow, income capitalization, and residual techniques. Emphasizes investment and lease valuation models and looks at their role in providing essential income and cash flow measurements.

MSRE 6241. Advanced Topics in Real Estate. (3) Special varying topics that allow students to focus on any functional area of real estate.

MSRE 6242. Asset Management. (3) Introduction course to asset management that focuses on how to increase value through management of operations, as well as the asset itself. Provides an understanding of lease analysis, maintenance and construction, reporting and insurance, property valuation, and measuring performance and providing recommendations.

MSRE 6245. Real Estate Market Analysis. (1 to 3) Application of analytical process for evaluating the market potential of both developed and undeveloped real estate. Provides a broadened historic perspective on modern city and understanding of how to apply analytical framework to real estate market analysis. Focuses on the process and documents associated with acquiring and disposing of commercial real estate areas.

MSRE 6250. Advanced Urban and Regional Economics. (3) Cross-listed Course(s): ECON 6250. Prerequisite(s): MSRE 5110 and MSRE 5131. Applications of microeconomic theory to problems of cities, metropolitan areas and regions,

methods in regional analysis, location theory, land-use planning, measurement of economic activity; transportation, housing, poverty and growth issues.

MSRE 6258. Site Feasibility Analysis. (3) Cross-listed Course(s): GEOG 6305 and MBAD 6258. Prerequisite(s): MSRE 5110 and MSRE 5131. Examination of factors affecting the feasibility of land parcels for commercial and residential development with emphasis on the physical evaluation of a given site, the market support for its intended use, and the financial support for the proposed development.

MSRE 6259. Applied Real Estate Development. (3) Cross-listed Course(s): GEOG 6105 and MBAD 6259. Prerequisite(s): MSRE 6159, MBAD 6159, or GEOG 6103. The application of the processes involved in real estate development. Students work in groups on a semester project to select a site and prepare an appropriate development plan that emphasizes the market and financial feasibility of the real estate development.

MSRE 6310. Land Use Policy. (1.5) Provides a better understanding of the legal and administrative framework used to regulate land use. Students learn about zoning laws and procedures, takings, regulatory takings, and eminent domain legal constraints impacting real estate development.

MSRE 6999. Real Estate Capstone. (3) Prerequisite(s): All prerequisite and required core courses of the MSRE curriculum. Designed to bring together the topics covered in the MSRE program and examine how they relate to each other. Students complete applied group projects, as well as conduct independent research, to explore issues of interest to the real estate industry. All of these projects encourage students to develop their leadership and negotiation skills, as well as consider ethical issues commonly faced by real estate professionals.

Urban Design (MUDD)

MUDD 5101. Design Studio: Basics. (3) Prerequisite(s): B.A., B.S. or equivalent college degree. This introductory graduate course in architecture is intended for students newly admitted to the School of Architecture's 3+ year professional program. This five-week, intensive studio-based course includes an introduction to freehand drawing, 2-D composition, 3-D modeling, and visual theory. In addition, the course offers an introduction to a variety of related topics (history, urbanism, structure, lighting, materials, etc.) that serve as critical departure points for understanding and making architectural and urban projects.

MUDD 5601. Community Planning Workshop. (3) Cross-listed Course(s): ARCH 6050 and GEOG 6501. Serves to acquaint students with contemporary theory and practice in planning and urban design; to give students experience in applying planning and urban design theory and methods to actual problems; to provide students with experience in compiling and analyzing community scale data, working with citizens, professional planners and designers, and elected officials, to provide students with experience in the preparation of oral reports and technical documents; and to examine what it means for the planner and urban designer to demonstrate ethical responsibility to the public interest, to clients and employers, and to colleagues and oneself.

MUDD 5602. Planning, Law, and Urban Design. (3) Examines the impact of planning law on the urban form of cities, both historically and in terms of contemporary professional practice. It surveys the impacts of planning regulations from Philip of Spain's "Laws of the Indies" at the beginning of American colonization through the development of English common law property rights, their extension to America and the development of zoning and planning legislation during the 20th century. Special attention is paid to current applications of form-based zoning codes in Britain and America and their implications for urban design and the patterns of settlement.

MUDD 6050. Urban Design Elective. (3) Study of topical areas of urbanism and urban design. May include courses from the M.A. in Geography (Community Planning Track) program and/or Master of Science in Real Estate (MSRE) program by permission of the Director of the M.U.D Program. *May be repeated for credit with change of topic.*

MUDD 6100. Directed Independent Study. (1 to 3) Prerequisite(s): Permission of the M.U.D Program Director and the graduate faculty member advising the study. Directed individual study and in-depth analysis of a special area related to the interests of the student and the expertise of the advising faculty member. May generally be taken once for credit towards degree.

MUDD 6101. Fundamentals of Urban Design Studio. (6) This introductory urban design studio focuses on fundamental concepts as well as the acquisition and practice of a wide range of technical and graphic skills and media. It is intended to serve as an arena to explore and test issues focused around the making of sustainable public infrastructure, spatial definition by buildings, and the particular dynamics of civic and social spaces.

MUDD 6102. Urban Design Studio II. (6) Prerequisite(s): MUDD 6101. This intermediate design studio focuses on the sustainable development of neighborhoods, districts, sites and urban open spaces, exploring design process

issues as well as the continued acquisition and practice of a variety of technical and graphic skills. (*Spring)*

MUDD 6204. Geographic Information System. (3) An applied research course focused on the broader technical issues of what a contemporary geographic information system (GIS) is and how the system can help us model and better understand the dynamic complexities of a city. Students are introduced to a mix of geographic information system theory and applications to urban design and planning problems. Topics include: geographic projection and coordinate systems, data management, models of spatial data, spatial analysis techniques, and GIS implementation issues.

MUDD 6205. Modern City: Theories and Forms. (3) Cross-listed Course(s): ARCH 4205, ARCH 5204, and ARCH 6050. An historical survey of urban design from the mid-19th century to the end of the 20th century, focusing on various ideas of urbanism and their impact on the contemporary practice of urban design and development. It investigates the cities and large-scale urban projects resulting from revolutionary ideas of urban design and important theories of urbanism. The course is organized with topical discussions on the emergence of modern city planning, monumental city, garden city, suburbanization, new urbanism, ecological urbanism, and global city among other paradigms of modern city.

MUDD 6606. GIS and Urban Mapping. (3) This applied research course is focused on the broader technical issues of what a contemporary geographic information system (GIS) is and how the system can help us model and better understand the dynamic complexities of a city. Introduces students to a mix of geographic information system theory and applications to urban design and planning problems. Topics include: geographic projection and coordinate systems, data management, models of spatial data, spatial analysis techniques, and GIS implementation issues.

MUDD 7102. Urban Design Studio III. (3 or 6) Prerequisite(s): MUDD 6102. This final studio is the capstone of the Urban Design Program. It focuses on site-specific projects in countries outside the U.S. and emphasizes methods of research and design, as well as technological and systemic issues of sustainability in dense and vertical urban environments. It pursues a directed research and design agenda that varies according to faculty interest, expertise, and/or project requirements.

MUDD 7103. Vertical Urbanism / Global Urban Design Studio, Part II. (3) Prerequisite(s): MUDD 6102 and MUDD 7102. Part two of an advanced, two-part design studio focuses on site-specific projects in countries outside the USA and emphasizes methods of research and design as well as technological and systemic issues of sustainability in dense and vertical urban environments. Part II is held in Charlotte and completes the design projects commenced abroad. Pursues a directed research and design agenda that varies according to faculty interest, expertise and/or project requirements. May build upon the resources of the City.Building.Lab (CBL) at the School of Architecture.

MUDD 7120. Graduate Summer International Study. (3 to 6) Prerequisite(s): Approval of the M.U.D Program Director. The premise of this course is to allow graduate students to engage a summer experience abroad to support their growing knowledge of architecture and architectural discourse. This experience is intended to inform and motivate possible interests that the students might pursue in further study.

MUDD 7134. Independent Capstone Research Project (6) Prerequisite(s): MUDD 6102. This is an alternative capstone course to MUDD 7102/7103 for students in exceptional circumstances only. This advanced project offers support and structure for students undertaking their capstone experience as individualized research and/or design work within the parameters of the M.U.D program but outside the normative full-time sequence of studios or as part of a dual degree option with an individually tailored course plan. An individually defined urban research and/or design project will be taken under the direction of a M.U.D faculty member and other advisors as appropriate.

Music Performance (MUPF)

MUPF 6120. Graduate Choral Ensemble. (1) Prerequisite(s): Audition. Corequisite(s): MUPF 6120L. A mixed chorus that performs music of many styles from the Baroque period to the present. 3 contact hours. *May be repeated for credit.*

MUPF 6120L. Graduate Choral Ensemble Sectional Rehearsals. (0) Corequisite(s): MUPF 6120. Sectional rehearsals for MUPF 6120. *May be repeated.*

MUPF 6253. Applied Music: Voice. (2) Prerequisite(s): Admission to the Graduate Certificate in Vocal Pedagogy program. Corequisite(s): MUPF 6253L and approved principle ensemble. Consists of private instruction, a one-hour lesson per week leading to a formal jury at the end of the semester. *May be repeated for credit.*

MUPF 6253L. Voice Masterclass. (0) Corequisite(s): MUPF 6253. Weekly masterclasses for MUPF 6253. *May be repeated.*

MUPF 6400. Graduate Recital. (0) A graduate-level recital of solo and ensemble repertoire performed before a jury of faculty members and the general public. See the Department of Music *Student Handbook* for details.

Music (MUSC)

MUSC 5001. Topics in Music. (1 to 6) Prerequisite(s): Admission to MAT or MME and permission of the instructor. Special topics in music; *May be repeated for credit.* Specific topics courses will be field-tested and modified to become permanent courses.

MUSC 5137. Graduate Vocal Pedagogy I. (3) Prerequisite(s): Admission to the Graduate Certificate in Vocal Pedagogy program. Surveys the history of vocal pedagogy from Manuel García to present-day pedagogues, as well as investigates areas of interest such as singing psychology, repertoire selection, methodology development, and complementary training.

MUSC 5153. Graduate Vocal Pedagogy II. (3) Prerequisite(s): MUSC 5137. Researches vocal mediation and remediation by examining pathologies, predisposing conditions, age-specific needs, health and care protocols, and ethics.

MUSC 5230. Form and Analysis. (3) Prerequisite(s): admission to the Graduate Certificate in Violin program. The impact of form and process on the analysis and interpretation of music. A detailed examination of common practice forms such as Binary, Ternary, Rondo, Theme and Variation, and Sonata form.

MUSC 6453. Voice Teaching Internship. (2) Prerequisite(s): Admission to the Graduate Certificate in Vocal Pedagogy program. Applied teaching with a select number of students, both male and female, and a weekly seminar to review and discuss issues and solutions in the studio and in another vocal-teaching contexts (e.g., choral, opera, ensemble, etc.), as appropriate. Students develop and document a systematic teaching methodology, learn how to select appropriate repertoire based on singer ability, and apply appropriate protocols for technical issues. *May be repeated for credit.*

MUSC 6600. Concluding Seminar. (3) Prerequisite(s): Admission to the Graduate Certificate in Vocal Pedagogy program. Concluding Seminar consists of a Directed Learning Project, enabling the student to focus on his or her area of pedagogical interest. Students are mentored through the project by a supervising instructor. Concluding Seminar is intended to provide a learning experience for students to gain additional knowledge that reinforce their Vocal Pedagogy program and support student career goals.

Nanoscale Science (NANO)

NANO 8001. Perspectives at the Nanoscale. (2) NANO program faculty members present and discuss their research in nanoscale science to: (1) demonstrate how scientists from different disciplines approach problem-solving at the nanoscale, and (2) expose students to research opportunities for dissertation work. Students write summaries of the presentations.

NANO 8060. Special Topics in Nanoscale Science. (1 to 3) Prerequisite(s): Permission of instructor. Selected topics in nanoscale science. *May be repeated for credit.*

NANO 8101. Introduction to Instrumentation and Processing at the Nanoscale. (3) Cross-listed Course(s): OPTI 6301 and OPTI 8301. Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering.

NANO 8102. Nanoscale Phenomena. (3) Cross-listed Course(s): CHEM 6102, OPTI 6302, and OPTI 8302. Topics include: scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines.

NANO 8103. Synthesis and Characterization of Nanomaterials. (3) Cross-listed Course(s): CHEM 6103. Prerequisite(s): NANO 8101 and NANO 8102, or permission of instructor. Topics include: quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organic-inorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres, porous silicon, photonic crystals.

NANO 8104. Fabrication of Nanomaterials. (3) Prerequisite(s): NANO 8101. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders.

NANO 8105. Life at the Nanoscale. (3) Prerequisite(s): Admission to the Ph.D. in Nanoscale Science program or

permission of instructor. Discusses the four major biological molecules (nucleic acids, proteins, lipids, carbohydrates) with an emphasis on energetics, evolution, structure, and self-assembly. In addition, common methods for the analysis and preparation of biological materials are presented. Students are also introduced to specific topics such as cell signaling, antibody and nucleic acid aptamer development, viral and liposomal nanoparticles, as well as core concepts in molecular and synthetic biology.

NANO 8203. Collaborative Research Proposal. (3) Cross-listed Course(s): OPTI 6303 and OPTI 8303. Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills.

NANO 8301. Nanomedicine. (3) Prerequisite(s): Permission of instructor. The basic principles of the design, synthesis, and characterization of nanomaterials for medical applications. Topics include: general characteristics of nanoparticles; common biological barriers; factors affecting interactions between nanoparticles and biological systems; and recent advances in nanoparticle design within the context of biomedical applications. Specific applications such as cancer biology, immunotherapy, cancer diagnostics and therapeutics, and translating nanotechnology platforms into the clinic are also discussed.

NANO 8351. Nanoscale Materials for Energy Applications. (3) Prerequisite(s): Permission of instructor. Explores the role of nanoscale science and nanoscale materials in energy applications, including the areas of energy production (e.g., solar photovoltaics and thermoelectrics), energy storage (e.g., batteries, supercapacitors, solar fuels), and energy sustainability (e.g., carbon sequestration and gas storage). Emerging topics in this rapidly evolving field are also addressed.

NANO 8352. Spectroscopy of Nanomaterials. (3) Prerequisite(s): Permission of instructor. Explores three main areas: (1) fundamentals, including electronic structure theory of bulk solids and molecules, restriction of electronic wavefunctions in one or more dimension, and the theory of excitons in nanomaterials; (2) spectroscopy, including interactions of light with matter, spectroscopic probes of nanoscale electronic structure, and consequences of inhomogeneity; and (3) photoexcitation dynamics, including electron/energy transfer involving nanomaterials, unique phenomena, and future applications.

NANO 8353. Supramolecular Chemistry of Nanomaterials. (3) Prerequisite(s): Permission of instructor. Explores the design, synthesis, and applications of supramolecular nanomaterials. Introduction to the background and development of the field, analytical methods, design of supramolecular building blocks, active areas of research, and applications of new materials. Topics include: the thermodynamics of molecular recognition, host-guest chemistry, self-assembly, mechanical bonding, solid-state supramolecular chemistry, and supramolecular polymerization.

NANO 8354. Solar Applications of Nanomaterials. (3) Prerequisite(s): Permission of instructor. Addresses the rational design of devices and systems aimed at exploiting the advantages of nanomaterials for solar energy conversion, and covers the principles of light harvesting, charge separation, and free-charge carrier collection within the realm of recent advances in contemporary solar device engineering and architectures. Fundamental theories and concepts are discussed. Several hands-on laboratory opportunities are incorporated to enable students to learn about device structures and testing.

NANO 8400. Nanoscale Science Internship. (1 to 9) Prerequisite(s): Completion of 18 credit hours of NANO courses or the equivalent; and permission of the Nanoscale Science Program Director. Full- or part-time internship in nanoscale science complementary to the major course of studies and designed to allow course-based practical learning to be applied in a supervised professional experience.

NANO 8681. Nanoscale Science Seminar. (1) Students learn about current research in the field of nanoscale science and related disciplines by attending weekly seminars of the Ph.D. in Nanoscale Science program. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

NANO 8682. Nanoscale Science Colloquium. (1) Students present seminars on current topics in nanoscale science, including dissertation research, the scientific literature, and special topics. *May be repeated for credit.*

NANO 8900. Dissertation Research. (1 to 4) Research for the dissertation. *Graded on a Satisfactory*

Progress/Unsatisfactory Progress basis each term. May be repeated for credit.

Nurse Anesthesia (NUAN)

NUAN 6151. Principles of Nurse Anesthesia I. (3)
Corequisite(s): NUAN 6156. Overview of the principles, techniques and equipment necessary for the administration of anesthesia for the general surgical client.

NUAN 6152. Principles of Nurse Anesthesia II. (3)
Prerequisite(s): NUAN 6151. Provides nurse anesthesia students with specific techniques of nurse anesthesia practice for selected clients.

NUAN 6153. Principles of Nurse Anesthesia III. (3)
Prerequisite(s): NUAN 6152. Advanced nurse anesthesia practice for selected patients. (*Summer)*

NUAN 6154. Advanced Pharmacology of Non-Anesthetic Agents. (4) Prerequisite(s): NUAN 6156. An exploration of advanced pharmacological concepts and clinical application of non-anesthetic drugs and adjunct agents commonly used in the anesthetic arena.

NUAN 6155. Advanced Pharmacology in Anesthetic Agents. (4) Corequisite(s): NUAN 6156. An exploration of advanced pharmacological concepts and clinical application of anesthetic drugs.

NUAN 6156. Applied Physics and Chemistry in Nurse Anesthesia. (3) Prerequisite(s): Admission to the major. Basic laws and principles of physics, inorganic, organic, and biochemistry as they apply to the clinical practice of nurse anesthesia.

NUAN 6157. Advanced Applied Pathophysiology in Nurse Anesthesia I. (3) Prerequisite(s): BIOL 6273. A study of advanced concepts of the pathophysiologies of the nervous, respiratory, cardiac, renal, and endocrine systems with emphasis on their anesthetic implications.

NUAN 6158. Advanced Applied Pathophysiology in Nurse Anesthesia II. (3) Prerequisite(s): NUAN 6157. A study of advanced concepts of the pathophysiologies of the nervous, respiratory, cardiac, and hepatobiliary systems, emphasizing anesthetic implications and management.

NUAN 6171. Professional Aspects of Nurse Anesthesia I. (1)
Corequisite(s): NUAN 6153 and NUAN 6485. Overview of the professional aspects of nurse anesthesia practice including history of the profession and professional associations, legal aspects, risk management, and the professional role.

NUAN 6172. Professional Aspects of Nurse Anesthesia II. (1)
Prerequisite(s): NUAN 6171. Corequisite(s): NUAN 6486. Overview of the professional aspects of nurse anesthesia practice including economic considerations, political challenges, evolving role in the health care system, administrative responsibilities, practice regulations, and ethical principles.

NUAN 6485. Clinical Residency in Nurse Anesthesia I. (5)
Prerequisite(s): NUAN 6153 and satisfactory completion of Clinical Orientation. Clinical application of didactic material from the nurse anesthesia curriculum through beginning level practice in the role of a nurse anesthetist. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Graded on a Pass/Unsatisfactory basis.*

NUAN 6486. Clinical Residency in Nurse Anesthesia II. (5)
Prerequisite(s): NUAN 6485. Continuation of the clinical application of didactic material from the nurse anesthesia curriculum with focus on utilization of additional anesthesia techniques and increased skills development. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Graded on a Pass/Unsatisfactory basis.*

NUAN 6487. Clinical Residency in Nurse Anesthesia III. (5)
Prerequisite(s): NUAN 6486. Incorporation of the content of the nurse anesthesia curriculum with opportunities to begin synthesis of all didactic material and techniques for efficient clinical practice. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Graded on a Pass/Unsatisfactory basis.* (*Summer)*

NUAN 6489. Clinical Residency in Nurse Anesthesia IV. (5)
Prerequisite(s): NUAN 6487. Final residency for synthesis of all didactic material and techniques of nurse anesthesia clinical practice, promotion of professional practice, and preparation of the student for national certification examination. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Graded on a Pass/Unsatisfactory basis.*

NUAN 8154. Advanced Pharmacology of Non-Anesthetic Agents. (4) Prerequisite(s): NUAN 8155 and Admission to the DNP in Nurse Anesthesia program. An exploration and analysis of the pharmacological concepts of non-anesthetic drugs and the clinical application of non-anesthetic drugs commonly used in the anesthetic arena for the surgical client. The course provides the pharmaceutical knowledge necessary to evaluate and pharmacologically manage the effect of non-anesthetic drugs in the preoperative, intraoperative, and postoperative periods. This foundation of therapeutic decision-making in non-anesthetic drug selection for the surgical client based on health problems, individual

variations, and current evidence-based principles are explored.

NUAN 8155. Advanced Pharmacology of Anesthetic Agents. (4) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. An exploration and analysis of the pharmacological concepts of anesthetic drugs and the clinical application of anesthetic drugs. Covers the pharmaceutical knowledge necessary to evaluate and pharmacologically manage and interpret a client's anesthetic needs through a continuum of health and surgical requirements in a safe and effective manner. The foundations of therapeutic decision-making in drug selection for the client based on health problems, individual variations, and current evidence-based principles are provided.

NUAN 8156. Applied Physics and Chemistry in Nurse Anesthesia. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. The foundational knowledge of the basic laws and principles of physics, inorganic chemistry, and organic chemistry as they apply to clinical practice of nurse anesthesia. Students gain the necessary knowledge to apply the principles of chemistry and physics in the safe administration and evaluation of an individual anesthetic care plan for the general surgical client. This course also provides students with the foundational knowledge to manage and maintain a safe anesthesia workstation.

NUAN 8157. Advanced Pathophysiology in Nurse Anesthesia I. (3) Prerequisite(s): NURS 6273 and Admission to the DNP in Nurse Anesthesia program. The foundational knowledge of the more common pathophysiologies of the nervous, respiratory, cardiac, liver, kidney and endocrine systems, with emphasize on their anesthetic implications. Students evaluate, interpret, and manage the surgical population's physiological response to anesthesia and to apply therapeutic decision-making in anesthetic related alterations in hemostasis.

NUAN 8158. Advanced Pathophysiology in Nurse Anesthesia II. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. Pre- or Corequisite(s): NUAN 8157. Builds on the foundational knowledge and offers advanced knowledge of the more common pathophysiologies of the nervous, respiratory, cardiac, and liver systems emphasizing anesthetic implications. Provides expanded knowledge on the ability to evaluate, interpret, and manage the complex surgical population's physiological response to anesthesia and to apply therapeutic decision-making in anesthetic related alterations in hemostasis. An introduction to the basic genomics of anesthetic is also provided.

NUAN 8161. Principles of Nurse Anesthesia I. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. The foundational knowledge of anesthetic principles, techniques, and equipment that is necessary to administer and manage an individual anesthetic plan to the general surgical client. Provides the necessary knowledge to evaluate, interpret, and manage a general surgical client's hemodynamic and physiological response to anesthesia and to apply therapeutic decision-making in anesthetic related alterations in hemostasis. Offers an overview of the principles, techniques, and equipment necessary for the administration of anesthesia for the general surgical client.

NUAN 8162. Principles of Nurse Anesthesia II. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. Pre- or Corequisite(s): NUAN 6151. The foundational knowledge of anesthetic principles, specific techniques, and equipment that is necessary to manage and deliver the care needed to selected clients such as the uncomplicated and complicated obstetric and pediatric patient. Students evaluate, interpret, and manage the hemodynamic and physiological response to anesthesia and apply therapeutic decision-making in anesthetic related alterations in hemostasis for selected populations.

NUAN 8163. Principles of Nurse Anesthesia III. (3) Prerequisite(s): NUAN 6151, NUAN 6152, and Admission to the DNP in Nurse Anesthesia program. Provides anesthesia students with advanced knowledge of anesthetic principles, techniques, and equipment that is necessary to manage and deliver the care needed to specific complicated patients. Students augment their knowledge and ability to evaluate, interpret, and manage the hemodynamic and physiological response to anesthesia and to apply therapeutic decision-making in anesthetic related alterations in hemostasis. The radiology component introduces the nurse anesthesia student to the fundamentals of radiology and outlines basic radiologic principles and radiation safety. Various radiologic techniques are identified, as well as interpretation of radiology examinations. Alternate radiographic techniques such as CT Scan, MRI, and ultrasound are discussed.

NUAN 8164. Principles of Nurse Anesthesia IV. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. Pre- or Corequisite(s): NUAN 8163. Provides anesthesia students with advanced knowledge of anesthetic principles, techniques, and equipment that is necessary to manage and deliver care to specific complicated patients. Students augment their knowledge and ability to evaluate, interpret, and manage the hemodynamic and physiological response to anesthesia and to apply therapeutic decision-making in anesthetic related alterations in hemostasis for selected complicated populations. The regional anesthesia component introduces and builds on the foundational knowledge of regional anesthesia. neuraxial anesthesia, upper and lower peripheral blocks, and airway anesthesia. This course also

educates advanced techniques of arterial and central venous access with the use of ultrasound technology.

NUAN 8171. Professional Aspects of Nurse Anesthesia. (3) Prerequisite(s): NUAN 8488. Corequisite(s): NUAN 8489. An overview of the professional, ethical, and legal aspects of the practice of nurse anesthesia and the American Association of Nurse Anesthetists.

NUAN 8172. Nurse Anesthesia Review. (2) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program or permission of instructor. A thorough and in-depth review of major anesthesia concepts. Conceptual review includes chemistry and physics, physiology, pathophysiology, pharmacology, anesthesia related equipment, instruments, technology, basic and advanced principles of anesthesia, and professional aspects of anesthesia practice.

NUAN 8484. Clinical Residency in Nurse Anesthesia I. (1) Prerequisite(s): NUAN 6152. Corequisite(s): NUAN 6153. An orientation to the clinical environment and the initial application of didactic material from the nurse anesthesia curriculum to care for the uncomplicated adult patient. 120 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*

NUAN 8485. Clinical Residency in Nurse Anesthesia II. (2) Prerequisite(s): NUAN 8163. Corequisite(s): NUAN 8164. The clinical application of didactic material from the nurse anesthesia curriculum through the beginning level practice in the role of a nurse anesthetist. Allows incorporation of the content of the nurse anesthesia curriculum with opportunities to apply didactic material and techniques for effective and efficient clinical practice. 240 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*

NUAN 8486. Clinical Residency in Nurse Anesthesia III. (4) Prerequisite(s): NUAN 8164. Pre- or Corequisite(s): NUAN 8485. The clinical application of didactic material from the nurse anesthesia curriculum through beginning levels of practice in the role of a nurse anesthetist. Conferences during the clinical residency provide opportunity to review current research and practice issues. 480 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*

NUAN 8487. Clinical Residency in Nurse Anesthesia IV. (4) Prerequisite(s): NUAN 8486. Continuation of the clinical application of didactic material from the nurse anesthesia curriculum with focus on utilization of additional anesthesia techniques and increased skill development in practice settings. 480 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*

NUAN 8488. Clinical Residency in Nurse Anesthesia V. (4) Prerequisite(s): NUAN 8487. Continuation of application of the nurse anesthesia curriculum with opportunities to synthesize didactic material and techniques for effective and efficient clinical practice. Conferences during the clinical residency provide opportunity to review current research and practice issues. 480 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*
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NUAN 8489. Clinical Residency in Nurse Anesthesia VI. (4) Prerequisite(s): NUAN 8488. Offers the final clinical residency for synthesis of all didactic material and techniques of nurse anesthesia clinical practice, promotion of professional practice, and preparation of the student for the national certification examination. Conferences during the clinical residency provide opportunity to review current research and practice issues. 480 supervised clinical hours. *Graded on a Pass/Unsatisfactory basis.*

Nursing Practice DNP (NUDN)

NUDN 8140. Foundations and Applications of Evidence-Based Practice. (3) An overview of models of Evidence-Based Practice, including theories and methods of translational research.

NUDN 8145. Leadership and Project Planning. (3) Introduction to advanced leadership theories to facilitate management of clinical projects.

NUDN 8147. Applied Biostatistics. (3) Emphasizes statistical literacy and develops critical statistical thinking. Students analyze data sets and communicate statistical results in a concise, cohesive, and readable manner.

NUDN 8150. Healthcare Program Evaluation and Quality. (3) An evaluation research course in healthcare settings. Emphasis is on conceptual, methodological, organizational, political, and ethical considerations in evaluating programs.

NUDN 8160. Global Health and Social Justice. (3) An interdisciplinary human rights and social justice perspective of contemporary issues, problems and controversies that effect social, economic, political, and environmental global health.

NUDN 8202. Community Epidemiology. (3) Principles and methods of epidemiology including definitions and models of health, illness and disease; modes of transmission of clinically important infectious agents; risk factors and chronic diseases; and insights into existing studies and paradigms of health promotion and disease prevention.

NUDN 8220. Healthcare Policy and Ethics. (3) Examines healthcare policy development strategies including the analysis of variables impacting policy implementation (e.g. politics and ethics).

NUDN 8230. Economic and Financial Aspects of Healthcare System. (3) Explores the study of financial and business factors related to health care delivery systems and advanced practice nursing.

NUDN 8260. Leadership and Healthcare Systems. (3) Examines challenges and political issues impacting strategies for organizational design to promote communication, collaboration, conflict management, power sharing, and innovation.

NUDN 8270. Technology for Communication and Transforming Healthcare. (3) Provides opportunities to explore current theories/practices in information systems and health communication, and develop innovative strategies for using emerging information and communication technologies to facilitate patient care and inter-professional collaboration.

NUDN 8280. Leveraging the Clinical Practice Doctorate for Career Advancement. (3) Prerequisite(s): NUDN 8442 and enrollment in DNP program. Focuses on strategies to advance professional career of nurses earning practice doctorate. Emphasis on elevating career, expanding role, improving clinical practice by communicating benefits of practice doctorate, developing collaborative relationships, and disseminating scholarly work.

NUDN 8441. Clinical Residency and Project Development I. (2) The first of a four-course series that results in a scholarly DNP project. Students negotiate learning objectives with the course instructor for the practicum.

NUDN 8442. Clinical Residency and Project Development II. (2) The second of a four-course series that results in a scholarly DNP project. Builds on NUDN 8441 with a focus on project planning and translation of new knowledge into practice.

NUDN 8443. Clinical Residency and Project Development III. (3) The third of a four-course series that results in a scholarly DNP project. Builds upon knowledge gained in NUDN 8441 and NUDN 8442. Students implement the clinical project in the practice setting.

NUDN 8444. Clinical Residency and Project Development IV. (2) The last of a four-course series that results in a scholarly DNP project. Provides a culmination of NUDN 8441, NUDN 8442, and NUDN 8443. DNP students evaluate the outcomes and impact of the project and disseminates the findings.

NUDN 8641. Project Development I. (1) Pre- or Corequisite(s): NUDN 8140. The first in a four course series that corresponds with the DNP Scholarly Project. Examines identification and need for change in complex healthcare organizations, refining a problem statement, assessing need, and proposing a change in practice based on scientific evidence.

NUDN 8642. Project Development II. (2) Pre- or Corequisite(s): NUDN 8641. The second in a four course series that corresponds with the DNP Scholarly Project. Examines inter-professional, organizational, planning, and regulatory strategies in planning and executing evidence-based practice improvement projects in complex healthcare settings.

NUDN 8643. Project Development III. (1) Pre- or Corequisite(s): NUDN 8642. The third in a four course series that corresponds with the DNP Scholarly Project. Examines program implementation strategies, documentation of outcomes, and considerations for sustainability on changes in complex healthcare settings.

NUDN 8644. Project Development IV. (2) Pre- or Corequisite(s): NUDN 8643. The fourth in a four course series that corresponds with the DNP Scholarly Project. Examines termination of projects, assuring sustainability, and strategies for disseminating and reporting outcomes of practice-based projects.

NUDN 8999. DNP Clinical Elective. (1 to 4) Student initiate and conduct key components of an individual DNP clinical scholarly project or clinical hour contract with course implementation toward DNP Scholarly Project or required clinical hour completion. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

Mental Health Nursing (NUMH)

NUMH 6130. Advanced Psychiatric Mental Health Nursing Practice with Individuals. (2) Prerequisite(s): NUMH 6200. Corequisite(s): NUMH 6430. Provides a framework for the examination and application of the therapeutic process by advanced psychiatric mental health nurses with emphasis on theories from nursing as well as psychiatric, behavioral, and cultural sciences. Focuses on the development of the advanced psychiatric mental health nurse in a managed care or traditional healthcare environment as an individual therapist.

NUMH 6135. Advanced Practice Psychiatric Mental Health Nursing Practice with Groups and Communities. (2). Prerequisite(s): NUMH 6130 and 6430. Corequisite(s): NUMH 6435. Examination of the therapeutic process of advanced psychiatric mental health nursing with emphasis on groups and communities. Focuses on development of the roles of the advanced practice nurse in a managed care and traditional mental healthcare environment as a group therapist in the promotion of mental health in community settings.

NUMH 6200. Psychiatric Mental Health Theories and Constructs of Mental Healthcare. (3) Pre-or Corequisite(s): NURS 6101. Examination of theoretical frameworks underlying the practice of advanced psychiatric mental health nursing. Integration of biological, psychological, sociological and nursing theories into the student's individual theoretical framework for practice.

NUMH 6201. Seminars in Advanced Practice Psychiatric Mental Health Nursing. (1) Prerequisite(s): NUMH 6135 and 6435. Corequisite(s): NUMH 6401. Focuses on the components and professional issues of the advanced practice psychiatric mental health nurse in the care of the individuals, groups, and communities. Professional practice issues will be addressed. One hour of seminar/case presentation.

NUMH 6401. Internship in Advanced Practice Psychiatric Mental Health Nursing. (4) Prerequisite(s): NUMH 6135 and NUMH 6435. Corequisite NUMH 6201. Focuses on the application of the advanced practice psychiatric mental health nurse's role in the care of the individuals, groups, and communities. Professional practice issues will be addressed with preceptors and faculty. *240 clinical practice hours.*

NUMH 6430. Practicum in Advanced Practice Psychiatric Mental Health Nursing with Individuals. (2) Prerequisite(s): NUMH 6200. Corequisite(s): NUMH 6130. Application of the individual psychotherapeutic process incorporating therapeutic modalities from nursing as well as psychiatric, behavioral, and cultural sciences in selected clinical experiences. Clinical seminar, clinical conference, and faculty/peer supervision provide opportunities for development of the advanced practice psychiatric mental health nurse in a managed care or traditional healthcare environment. *120 clinical practice hours.*

NUMH 6435. Advanced Psychiatric Mental Health Nursing Practice with Groups and Communities Practicum. (2) Prerequisite(s): NUMH 6130 and 6430. Corequisite(s): NUMH 6135. Examination and application of the therapeutic process with emphasis on groups and communities. Clinical seminar, clinical experience and supervision, provide opportunity for development of the advanced practice psychiatric mental health nurse as a group therapist and in promotion of mental health in community settings in a managed care and traditional healthcare environment. *120 clinical practice hours.*

Nurse Practitioner (NUNP)

NUNP 6202. Complex Healthcare Management of Adults. (3) Prerequisite(s): NUNP 6250. Provides students with the opportunity to integrate knowledge from advanced assessment, pathophysiology, pharmacotherapeutics, theory and research to provide the advanced practice nurse with the requisite skills in the management of acutely ill adults in a variety of settings. Emphasis is placed on the use of diagnostic reasoning skills in the assessment, diagnosis, and plan of care, including pharmacological, and non-pharmacological management of acutely ill adults with urgent and emergent complex health issues. Application of models and theories to guide advanced nursing practice and planned evidence-based care of the adult with acute and/or chronic illness is expected in order to promote quality outcomes.

NUNP 6203 Advanced Care of Critically Ill Adults. (3) Prerequisite(s): NUNP 6202 and NUNP 6250. Provide students with the opportunity to integrate knowledge from advanced assessment, pathophysiology, pharmacotherapeutics, theory, and research to provide the advanced practice nurse with the requisite skills in the management of critically ill adults in a variety of environments. Emphasis is placed on the use of diagnostic reasoning skills in the assessment, diagnosis, and plan of care including pharmacological and non-pharmacological management of critically ill adults with life threatening, rapidly changing physiological, and pathophysiological conditions. Application of models and theories to guide advanced nursing practice and planned evidence-based care of adult with critical illness is expected in order to promote quality outcomes (240 supervised clinical hours).

NUNP 6240. Advanced Primary Care Reproductive Health. (3) Prerequisite(s): NURS 6220, NURS 6230, and NURS 6430. Pre- or Corequisite(s): NUNP 6250. Focuses on the role of the nurse practitioner in the primary care of family members in the reproductive stages. Uses a developmental approach to provide knowledge needed for advanced understanding and care of common health concerns related to the reproductive organs, including the genitourinary, and reproductive cycles of men and women. Concepts of health promotion, health maintenance, cultural competence and environmental variations are integrated throughout the course.

NUNP 6250. Advanced Primary Care and Health Promotion of Adults Across the Lifespan. (3) Prerequisite(s): NURS 6220, NURS 6230, and NURS 6430. Builds on knowledge of advanced assessment, pathophysiology, pharmacotherapeutics, and theory and research to provide the advance practice nurse with the framework to manage adults with chronic illness in healthcare settings. Emphasis is placed on a wellness focus in the care of adults throughout the life span with common reoccurring acute illnesses and stable chronic conditions. Models of health promotion, disease prevention, health education and wellness will be used to guide the advanced practice nurse in assessing, diagnosing and planning care for adults. The case study approach is

used as a framework to implement the diagnostic reasoning and clinical decision making process.

NUNP 6251. Advanced Acute and Preventive Care of Adults. (3) Prerequisite(s): Admission to the major. Builds on advanced assessment, pathophysiology, and pharmocology to provide the advanced practice nurse with the framework to manage adult preventive care for chronic illnesses in acute ambulatory settings. Emphasis is placed on preventive care in adults with common recurring acute and chronic conditions. Models of health promotion, disease prevention, and health education is used in assessing, diagnosing, and planning care.

NUNP 6260. Advanced Primary Care of Children and Adolescents. (3) Prerequisite(s): NURS 6220, NURS 6230, NURS 6430, NUNP 6250, and NUNP 6450. Corequisite(s): NUNP 6460. Focus is on the role of the family nurse practitioner in the primary care of families with children and adolescents. The course uses a developmental approach to providing knowledge needed for advanced clinical decision making related to children with common health problems including acute episodic illness and stable chronic disease. Concepts of health promotion and maintenance and cultural and environmental variables are integrated throughout.

NUNP 6400. Internship in Family Health Nursing. (4) Prerequisite(s): NUNP 6240, NUNP 6250, and NUNP 6260. Role of the family nurse practitioner in the assessment and management of the health of individuals and families across the lifespan. Implementation of clinical decision making skills in family health promotion and management of acute episodic and stable chronic conditions and consideration of professional practice issues. Includes one credit hour of seminar/case presentation and three credit hours of clinical practice. 240 clinical hours. Individually arranged. (*Summer)*

NUNP 6401. Advanced Care and Health Promotion Adults Practicum. (2) Pre- or Corequisite(s): NUNP 6250. Emphasis on the role of the advanced practice nurse in promoting healthy life-styles to prevent or minimize the effects of chronic illness. Students incorporate critical thinking and diagnostic reasoning in assessing, diagnosing, monitoring, coordinating, managing outcomes and communicating healthcare findings of adults and their families in individually arranged ambulatory care settings. 120 supervised clinical hours.

NUNP 6402. Advanced Practice Nursing in Complex Care Practicum. (4) Pre- or Corequisite(s): NUNP 6202. This clinical course focuses on treatment and outcome management of acutely ill clients with multi-system problems. Emphasis on the role of the advanced practice nurse in helping acutely ill adults manage the effects of urgent and emergent complex health issues and achieve quality outcomes in individually arranged ambulatory care settings. 240 supervised clinical hours.

NUNP 6403. Advanced Care of Critically Ill Adults Practicum. (4) Prerequisite(s): NUNP 6402. This clinical course focuses on the outcome management of critically ill adults with life threatening, rapidly changing physiological and pathophysiological conditions. Emphasis is on the role of the advanced practice nurse in developing, implementing and evaluating advanced care of critically ill adults. Clinical experiences are designed to provide opportunities in management and delivery of evidence-based care for the achievement of quality outcomes in a variety of healthcare environments. 240 supervised clinical hours.

NUNP 6431. Advanced Acute Care Skills Lab. (1) Pre- or Corequisite(s): NURS 6230 and NURS 6430. Clinical practicum provides an opportunity for students to learn and practice commonly encountered advanced critical care skills required for performing assessments and technical procedures on acutely and critically ill adults. 60 lab/clinical hours.

NUNP 6440. Advanced Primary Care Reproductive Health Practicum. (2) Pre- or Corequisite(s): NUNP 6240. This clinical course is designed to provide the family nurse practitioner student with the opportunity to manage the reproductive and GU care in primary care settings. Uses a developmental approach to increase competence in providing care to clients from diverse backgrounds. The focus is on the synthesis of knowledge from the physical and psychosocial sciences to formulate advanced clinical decisions effective in reproductive healthcare. 120 supervised clinical hours. Individually arranged.

NUNP 6450. Advanced Primary Care and Health Promotion of Adults Practicum. (2) Pre- or Corequisite(s): NUNP 6250. This clinical course is designed to provide family nurse practitioner students the opportunity to manage the healthcare of adults in primary care settings. Uses a developmental approach to manage the care of adults from diverse backgrounds. The focus is on the synthesis of knowledge from the physical and psychosocial sciences to formulate advanced clinical decisions effective in the healthcare of adults and their families. 120 supervised clinical hours. Individually arranged.

NUNP 6460. Advanced Primary Care of Children and Adolescents Practicum. (2) Prerequisite(s): NURS 6220, 6230, and 6430; NUNP 6250 and 6450. Corequisite(s): NUNP 6260. This clinical course is designed to provide family nurse practitioner students the opportunity to manage the healthcare of children and adolescents in primary care settings. Uses a developmental approach to guide management of the healthcare of children and

adolescents from diverse backgrounds. The focus is on the synthesis of knowledge from the physical and psychosocial sciences to formulate advanced clinical decisions effective in the healthcare of children and adolescents and their families. 120 clinical hours. Individually arranged.

Nursing (NURS)

NURS 6090. Selected Topics in Nursing. (1 to 3) Prerequisite(s): Permission of instructor. Topics to be chosen from the specialties of nursing. *May be repeated for credit with change of topic.* No more than six hours of topics and/or independent study course credit in nursing may be applied toward degree requirements.

NURS 6100. Chronic Illness Concepts and Theories for Advanced Nursing Practice. (3) Focus on contemporary chronic illness concepts and theories relevant to individuals and families coping with long-term health deviations and their impact on society. Emphasis on knowledge and skills needed for advanced nursing practice.

NURS 6101. Theoretical Basis for Nursing Practice. (3) Philosophical foundations and knowledge development in nursing. Evaluation of theories, models and their relationships to practice.

NURS 6115. Health Policy and Planning in the U.S. (3) Prerequisite(s): Graduate standing. Overview of the organization and financing of the healthcare delivery system in the United States. Analysis of healthcare policy, financing, political trends, ethical, and professional issues, including the theoretical underpinning of health policy making, the empirical thrusts of policy analysis and research, and the relationship between health policy making and political process in the practice of nursing and healthcare.

NURS 6150. Health of Immigrant Populations in the United States. (3) This course examines the health of immigrant populations within the context of a nation of origin, the process of migration, and resettlement experiences. Explores theoretical. frameworks that may explain socialization of groups to surrounding societies. Examines selected traditional healing modalities and essential components of culturally competent healthcare practice.

NURS 6160. Research in Nursing and Health Professions. (3) Methods of inquiry for research will be explored and critiqued nursing and the health professions. Emphasis is on translational research for evidence based developing skills useful for conducting and evaluating research, using research in practice and program evaluation.

NURS 6162. Information Resource Management. (3) Cross-listed Course(s): HADM 6146 and HCIP 6146. Adaptation of technological innovation (Informatics) to the field of nursing, including theoretical and applied computer utilization, patient acuity and quality assurance components to the professional practice of nursing.

NURS 6175. Nursing Informatics. (3) Adaptation of technological innovation (Informatics) to the field of nursing, including theoretical and applied computer utilization, patient acuity and quality assurance components to the professional practice of nursing.

NURS 6180. Community/Public Health Nursing Theory and Practice. (3) Examines how population-based theories and practice inform advanced practice community/public nursing in communities and schools. Focuses on core public health functions and competencies, public health law and ethics, the role of C/PHN in influencing public health policies, Healthy People goals and objectives, and collaboration with communities to assess, plan, develop, implement, and evaluate culturally competent health promotion programs.

NURS 6185. Theory and Application in the Organizational Behavior to Nursing Systems. (3) Prerequisite(s): NURS 6101 or permission of the instructor. Examination of organization theory, management theory and their applications to critical nursing administrative leadership issues. Standards and Frameworks of competencies in Nursing Administration are reviewed as guidelines for career development. Evidence-based management and promotion of a culture of safety is explored as a basis for health related organizational development.

NURS 6187. Financial, Human, and Information Technology Resource Management in Complex Systems. (3) Explores use of information systems for budgeting, finance, and decision-making for nurse leaders. Introduces information tools useful in analysis of decision-making and avoiding common decision errors that occur because of faulty ingrained beliefs and limitations of data. Emphasizes managerial aspects nurse leaders need in order to interact with the information technology applications utilized in financial and resource planning. Internal controls such as auditing concepts and techniques are introduced. Financial methods and informatics driven algorithms are presented as decision models for creating a culture of safety. The managerial implications of cost analysis, capital investment decisions, equity and debt financing, and lease/purchase decisions are included.

NURS 6188. Application of Nursing Informatics in Strategic Planning and Decision-Making. (3) Explores theories of strategic planning for nursing and healthcare organizations with an emphasis on nursing informatics applications in practice such as telehealth and the electronic medical

record. Identifying sources and information needed for identifying system vulnerabilities, strategic decision-making, and problem-solving techniques for analysis and forecasting are explored with attention to the organizational processes and context. Students learn to apply selected quantitative information management tools for planning services, implementing new technology, and evaluating strategic outcomes.

NURS 6202. Applied Epidemiology in Advanced Nursing. (3) Prerequisite(s): Admission to Graduate Nursing program. Explores concepts and methods of epidemiology applied to population-focused healthcare in advanced nursing practice. Emphasis is placed on social determinants of health, measures of health, principles and ethics in screening, surveillance, methods of control and prevention, and the design, analysis, and interpretation of epidemiological studies. Students use epidemiologic reasoning in examining the etiology of health outcomes and in guiding the design of health programs.

NURS 6206. Health Assessment for School Nurses. (3) Provides the knowledge and skills for school nurses to incorporate concepts from growth and development in a comprehensive health assessment of diverse children and adolescents. The focus is on identifying normal parameters and providing health promotion interventions. (3)

NURS 6207. Care of the Child and Adolescent in Schools. (3) Prerequisite(s): NURS 6206. Provides the knowledge and skills for needed by advance practice C/PHNs to manage the health of children and adolescents in schools. Builds on knowledge base of child and adolescent growth and development. Concepts of health promotion, family theory, behavioral health, culture and environmental health are integrated throughout the course.

NURS 6210. Family Health in Advanced Practice Nursing. (2) An overview of the family as the basic unit of advanced nursing care. Focuses on strategies of family assessment, family empowerment, and family health promotion. Includes reviews of relevant theories, concepts and research for the assessment and management of family health and the analysis of the socio-cultural context of families.

NURS 6211. Health Disparities and Nursing. (3) Examines various theoretical frameworks relative to interactions of ethnic heritage, cultural environment, and social/racial stratification, and development of cultural competence in Advanced Nursing Practice. It examines ethical, legal, regulatory standards that inform advanced practice and evaluates alternative strategies that nurses in advanced practice can use to provide culturally competent interventions to diverse populations, patients, organizations, and communities.

NURS 6212. Program Improvement and Evaluation. (3) Focuses on planning, evaluating, and improving health programs. Includes steps in problem analysis and needs assessment, logistics of program management and implementation, evaluation, and quality improvement within systems and community oriented advanced nursing practice.

NURS 6220. Pharmacotherapeutics in Advanced Nursing Practice. (3) Principles of pharmacology and drug therapy for advanced nursing practice including legal and social considerations related to prescriptive authority and prescribing patterns. Satisfies NC Board of Nursing requirements for nurse practitioner.

NURS 6230. Advanced Health Assessment and Diagnostic Reasoning for Advanced Practice. (3) Pre- or Corequisite(s): BIOL 6273 or BIOL 6274. Corequisite(s): NURS 6430. Provides the knowledge and skills necessary for advanced practice nurses to synthesize concepts from nursing and the biopsychosocial sciences in the comprehensive health assessment of adults and children. The diagnostic reasoning process, differential diagnosis, advanced health evaluation techniques, laboratory tests, diagnostic studies and interpretation and evaluation of findings are incorporated into the course. Collaborative relationships between the nurse practitioner role and the nurse anesthetist role are developed through analysis of case studies.

NURS 6273. Advanced Human Physiology. (3) Prerequisite(s): Admission to the DNP in Nurse Anesthesia program. Advanced course in human physiology stressing the interaction between physiological systems.

NURS 6274. Advanced Human Pathophysiology. (3) Prerequisite(s): Admission to Advanced Clinical Nursing major. Explores advanced physiologic and pathologic mechanisms of disease as a basis for advanced practice nursing. It emphasizes the study of underlying changes in human physiology that is the result of disease or injury. A focus on body systems and common disorders is provided.

NURS 6275. Health Promotion, Nutrition, and Wellness for Older Adults. (3) Cross-listed Course(s): GRNT 6275. Prerequisite(s): Graduate standing or permission of the instructor. Explores self-care measures and health promotion practices with an emphasis on nutrition, that promote a healthy lifestyle. Topics include: principles of teaching and learning adapted to diverse older adults' needs and learning styles. Common barriers to healthcare and appropriate nutrition in older adults are also examined. Current findings from research will be integrated throughout the course. A foundational knowledge of human development is expected.

NURS 6282. Interprofessional Collaboration in Healthcare. (3) Cross-listed Course(s): SOWK 5104. Focus on interprofessional collaboration competencies to prepare health professionals for team-based care of patients, families, and communities. Emphasis on applying team values and ethics, roles and responsibilities, communication practices, and collaboration to improve health outcomes and promote physical, mental, and social well-being of diverse populations.

NURS 6301. Curriculum and Instruction in Nursing Education. (3) Theories and principles of adult learning. Curriculum/course planning, design, implementation, and evaluation. Creative teaching approaches and technologies. Evaluation of student learning, including test construction. Teaching/ learning/evaluation in the clinical setting.

NURS 6302. Trends and Issues in Nursing Education. (3) Examination of current trends and issues that nursing educators face: faculty roles and responsibilities, student diversity, student roles and responsibilities, scholarship of teaching, leadership in nursing education, evaluation of teaching effectiveness, curriculum evaluation/accreditation, and legal and ethical issues.

NURS 6303. Instructional Technology in Nursing Education. (3) Introduction to instructional design using a variety of computer and technology-based media. The focus is on assisting students to gain skills in choosing appropriate instructional technologies in enhancing learning in both traditional and clinically-based educational settings.

NURS 6304. Teaching Practicum in Nursing Education. (3) Prerequisite(s): NURS 6301, NURS 6302, and NURS 6303. Guided experience with a master teacher in nursing for classroom and clinical teaching and evaluation, planned in the student's locale by student and faculty, plus online discussion forum. Design of a teaching portfolio. Design, implementation, and evaluation of course/class/clinical content. Includes 180 supervised clinical hours.

NURS 6305. Advanced Pathology and Pharmacology for Nurse Educators. (3) Prerequisite(s): Admission to Distance Education concentrations. Advanced knowledge of pathophysiology and pharmacology concepts for providing safe and effective nursing care. Focus on general pathophysiology principles that apply to individuals across the lifespan and the associated categories of pharmacological agents used in patient treatment. Does not fulfill requirements for students enrolled in APRN (nurse practitioner, nurse anesthesia) programs.

NURS 6306. Health Assessment for Nurse Educators. (3) Prerequisite(s): Admission to online programs. Advanced knowledge and skills for holistic health assessment of individuals across the lifespan. Focus on assessment of all human systems, with an emphasis on advanced health assessment concepts, approaches, and techniques. Designed for graduate nursing students with direct care focus; does not fulfill requirements for students enrolled in APRN (nurse practitioner, nurse anesthesia) programs.

NURS 6430. Advanced Health Assessment and Diagnostic Reasoning Practicum. (1) Pre- or Corequisite(s): BIOL 6273 or BIOL 6274. Corequisite(s): NURS 6230. This clinical practicum is designed to provide an opportunity for students to practice advanced health assessment skills on clients across the lifespan. Comprehensive health histories and physical examination techniques are used to complete a database on clients to formulate differential diagnoses and make advanced clinical decisions. Includes 60 lab/clinical hours.

NURS 6480. Community/Public Health Nursing Internship I. (3) Pre- or Corequisite(s): NURS 6180 and NURS 6212. Internship I is the first of a two-semester clinical course for students in population or school nursing options. It is competency-based and is designed to reflect population-based advanced practice nursing in multiple settings. Students work under direct supervision of an assigned MSN-prepared preceptor to assess the need for a project and then to design an intervention. The internship builds on knowledge and skills from prior courses in the program. Placement with a preceptor is determined individually in consultation with the student. Includes 180 clinical hours.

NURS 6481. Community/Public Health Nursing Internship II. (3) Prerequisite(s): NURS 6480. Internship II is the second of a two-semester clinical course that builds on knowledge and skills from prior courses in Community/Public Health Nursing. It is competency-based and is designed to reflect population-based practice in multiple settings. Students work under direct supervision of an assigned MSN-prepared preceptor to assess the need for a project and then to design an intervention. Placement continues with the same preceptor from Internship I. Includes 180 clinical hours.

NURS 6485. Advanced Practicum in Nursing Administration and Leadership. (3) Prerequisite(s): NURS 6185. This practicum provides a guided administrative experience in a health related agency. Designed as a course where students synthesize nursing research, practice and theory in a project for improving the culture of safety under the supervision of a selected preceptor. Includes 180 clinical hours.

NURS 6495. Nurse Educator Advanced Clinical Practicum. (3) Prerequisite(s): Admission to MSN with Nurse Educator concentration. This practicum course emphasizes clinical nursing practice at an advanced level. Students participate in direct care experiences with a clinical nurse preceptor

to advance clinical nursing expertise within a chosen specialty area, expanding upon prior clinical knowledge. Emphasis is placed on the application of evidence-based, collaborative, interdisciplinary solutions to improve healthcare outcomes of diverse individuals, families, and groups in a variety of settings. 180 supervised clinical hours.

NURS 6603. Synthesis in Advanced Nursing Practice. (3) Prerequisite(s): Admittance to MSN program. Students participate in a capstone experience in a selected topic area. The course prepares students to perform a rigorous critique of evidence derived from current research to generate evidence for clinical practice. It builds on existing theoretical and research foundations, and is taken in the last year of a student's program of study.

NURS 6661. Research Seminar. (2) Prerequisite(s): NURS 6160 and graduate statistics. Application of inquiry methods to nursing problems including systematic observation and critical analysis of research methods. Submission of a written research or project proposal is required.

NURS 6895. Independent Study. (1 to 3) Guided individual study in topics or issues related to nursing arranged with a faculty advisor. *May be repeated for credit.* No more than six hours of topics and/or independent study courses may be counted toward degree requirements.

Operations Management (OPER)

OPER 8122. Technology Enhanced Decision Making. (3) Prerequisite(s): MBAD 5141 and MBAD 5142 or equivalents. An analytical approach to the management process. Generalized models for decision making with major emphasis on application of the scientific method to management problems.

OPER 8208. Supply Chain Management. (3) Prerequisite(s): MBAD 6141. Pre- or Corequisite(s): MBAD 6122 or permission of department. Supply chain management is concerned with all of the activities performed from the initial raw materials to the ultimate consumption of the finished product. From a broad perspective, the course is designed to examine the major aspects of the supply chain: the product flows; the information flows; and the relationships among supply chain participants. The course content is interdisciplinary in nature and will cover a variety of topics such as supply chain information technologies, supply chain design, strategic alliances between supply chain participants and supply chain initiatives.

Operations Research (OPRS)

OPRS 5010. Topics in Decision Mathematics. (2 to 3) Prerequisite(s): Permission of department. Topics in decision mathematics selected to supplement regular course offerings in this area of mathematics. *May be repeated for credit with permission of department.* Credit for the M.A. degree in mathematics requires approval of the department.

OPRS 5111. Linear Programming. (3) Prerequisite(s): OPRS 3111 and ITCS 1214. Mathematical formulation and solution of linear programming problems. Topics include: the simplex method and its variations, sensitivity and parametric analysis, duality, and applications. A project will be required for all graduate students.

OPRS 5112. Nonlinear Programming. (3) Prerequisite(s): ITCS 1214, MATH 2241, and OPRS 3111. Basic unconstrained optimization problems, search techniques, some discussion of rates of convergence and an introduction to constrained optimization. Computer implementation and testing of optimization algorithms will be required. A project will be required of all graduate students.

OPRS 5113. Game Theory. (3) Prerequisite(s): OPRS 3111; and STAT 2122, MATH/STAT 3122, or OPRS 3113. The theory of zero-sum matrix games, mini-max theorem, optimal strategies, symmetric games, economic models, infinite, separable, polynomial, multi-stage, general-sum and n-person games. A project is required of all graduate students.

OPRS 5114. Dynamic Programming. (3) Prerequisite(s): ITCS 1214, OPRS 3111, and one of STAT 2122, MATH/STAT 3122 or OPRS 3113. The identification of dynamic programming problems and their solution in terms of recurrence relations. Elementary path problems, resource allocation, shortest path, traveling salesmen problem, discrete-time optimal control, replacement models and inventory systems. A project will be required of all graduate students.

OPRS 6101. Introduction to Operations Research. (3) Prerequisite(s): STAT 3122. Operations Research approach: modeling, constraints, objective and criterion. The problem of multiple criteria, optimization, model validation. The team approach. Systems design. Examples, or methodology: mathematical programming, optimum seeking, simulation, gaming, heuristic programming. Examples, or applications: theory of inventory, economic ordering under deterministic and stochastic demand. The production smoothing problem, linear and quadratic cost functions. Waiting line problems: single and multiple servers with Poisson input and output. The theory of

games for two-person competitive situations. Project management through probabilistic activity networks and deterministic activity network (CPM-PERT).

OPRS 7125. Stochastic Processes. (3) Basic ideas in the study of stochastic processes, selected from: discrete and continuous time Markov processes, stationary and renewal processes, applications to queuing theory, reliability theory, stochastic differential equations, time-series analysis, filtering and stochastic control theory.

OPRS 8101. Introduction to Operations Research. (3) Operations Research approach: modeling, constraints, objective and criterion. The problem of multiple criteria, optimization, model validation. The team approach. Systems design. Examples, or methodology: mathematical programming, optimum seeking, simulation, gaming, heuristic programming. Examples, or applications: theory of inventory, economic ordering under deterministic and stochastic demand. The production smoothing problem, linear and quadratic cost functions. Waiting line problems: single and multiple servers with Poisson input and output. The theory of games for two-person competitive situations. Project management through probabilistic activity networks and deterministic activity network (CPM-PERT).

OPRS 8125. Stochastic Processes I. (3) Basic ideas in the study of stochastic processes, selected from: discrete and continuous time Markov processes, stationary and renewal processes, applications to queuing theory, reliability theory, stochastic differential equations, time-series analysis, filtering and stochastic control theory.

Optical Science and Engineering (OPTI)

OPTI 5000. Selected Topics in Optics. (3) Prerequisite(s): Permission of Optics Program Director. Selected topics in optics from areas such as medical optics, adaptive optics, all optical networks, etc. *May be repeated for credit with change of topic.*

OPTI 5371. Waves and Optics. (3) Cross-listed Course(s): PHYS 5271. The mathematics of wave motion, light as an example of an electromagnetic wave, the superposition of periodic and non-periodic waves, and selected topics from geometrical and physical optics.

OPTI 5392. Solid State Microelectronic Devices. (3) Cross-listed Course(s): ECGR 5192. PN-junctions and Schottky junctions. Bipolar and field effect transistors. Optoelectronic and heterojunction devices. Lithography and integrated circuits. Microwave devices. Light emitting devices and detectors. Quantum devices using superlattices. Quantum wells and quantum dots. Material preparation and characterization. Measurement techniques.

OPTI 6000. Selected Topics in Optics. (3) Cross-listed Course(s): OPTI 8000. Prerequisite(s): Permission of Optics Program Director. Selected topics in optics from areas such as medical optics, adaptive optics, all optical networks, etc. *May be repeated for credit with change of topic.*

OPTI 6101. Mathematical Methods of Optical Science and Engineering. (3) Cross-listed Course(s): OPTI 8101. A comprehensive look at those mathematical techniques important to the understanding of optical phenomena. Includes vector algebra and calculus, matrix theory, Fourier series and transforms, complex analysis, solution of boundary value problems in partial differential equations, and special functions. Topical coverage emphasizes applications specific to the field of optics.

OPTI 6102. Principles of Geometrical Optics. (3) Cross-listed Course(s): OPTI 8102. Law of reflection and refraction, reflection and refraction at plane surfaces, paraxial imagery, mirrors, thick lenses, thin lenses, lens systems, stops, principle planes, the optical variant, vignetting, paraxial radiometry, analysis of common optical systems, real ray tracing, and introduction to aberrations and image resolution in the context of the modulation transfer function.

OPTI 6102L. Geometrical Optics Lab. (1) Cross-listed Course(s): OPTI 8102L. Selected experiments in areas of geometrical optics such as index of refraction measurement, dispersing and reflecting prisms, spherical mirrors and thin lenses, imaging, optical instruments, aberration, fiber optics, and fringe projection profilometry.

OPTI 6103. Light Sources and Detectors. (3) Cross-listed Course(s): OPTI 8103. Photon statistics and thermal light. Interactions of photons with atoms. Population inversion, lasing threshold, and resonator modes. Mode-locked and Q-switched lasers. Semiconductor photon sources including light-emitting diodes (LEDs) and laser diodes. Quantum-confined structures, materials, and devices. Thermal sources. Light extraction. Light detectors including photoconductive, photovoltaic and avalanche photodiodes. Noise in light sources and detectors.

OPTI 6104. Electromagnetic Waves. (3) Cross-listed Course(s): OPTI 8104. Optical phenomena that are explicitly associated with the electromagnetic nature of light. Includes an introduction to Maxwell's equations, and electromagnetic waves. Polarization and the Jones calculus. Energy and momentum conservation, boundary conditions and Fresnel equations. Waves in anisotropic (birefringent) and complex media. Modulation and

deflection of optical beams (principles of acousto-optics and electro-optic devices). Propagation at interfaces, waveguides, and plasmons. Electromagnetic potentials and multipole radiation, scattering of light, and interaction with metallic nanoparticles.

OPTI 6105. Optical Properties of Materials. (3) Cross-listed Course(s): OPTI 8105. Electromagnetic wave propagation in dielectrics, semiconductors and metals. Dipole oscillator model, complex dielectric constants, and Kramers-Kronig relationship. Crystal structures and optical anisotropy. Reciprocal space and density of states. Electronic band structure. Quantum theory of radiative absorption and emission, selection rules. Direct and indirect interband absorption. Free-carrier absorption in metals and doped semiconductors. Free excitons and Frenkel excitons. Photo- and electroluminescence in semiconductors. Optical absorption and emission in quantum wells and quantum dots, and quantum Stark effect. Second and third-order optical nonlinearities.

OPTI 6106. Principles of Physical Optics. (3) Cross-listed Course(s): OPTI 8106. The Fourier transform and its role in wave optics. Wave properties of light, superposition of waves, angular spectrum of plane waves, relation to ray optics, Gaussian beams, periodic structures and surfaces, Fresnel diffraction, spatial filtering diffraction, interference and interferometers (two, multibeam, Fabry-Perot), polarization, temporal and spatial coherence, holography, imaging and resolution.

OPTI 6106L. Physical Optics Lab. (2) Cross-listed Course(s): OPTI 8106L. Selected experiments in areas of physical optics such as interference in thin films, Fabry-Perot, Michelson & Twyman-Green interferometers, polarization and diffraction of light. By the end of this course, students are asked to design and implement a mini project that includes geometrical and physical optics concepts.

OPTI 6201. Fourier Optics and Holography. (3) Cross-listed Course(s): OPTI 8201. Prerequisite(s): OPTI 6102 and OPTI 6104. Principles of scalar, Fresnel, and Fraunhofer diffraction theory. Coherent optical data processing. Optical filtering and data processing. Holography. Three lecture hours per week.

OPTI 6202. Fundamentals of Biomedical Optics. (3) Cross-listed Course(s): OPTI 8202 and PHYS 6202. Basic principles underlying tissue optics, laser-tissue interactions, and optical imaging, microscopy, and spectroscopy for medical applications.

OPTI 6203. Metamaterials. (3) Cross-listed Course(s): OPTI 8203. Metamaterials describes a new field of engineered materials having subwavelength structures, and which have electromagnetic properties not found in nature. Examples include zero and negative index materials which lead to some new applications. Metamaterials are made from "meta-atoms" which are much smaller than the wavelength of the radiation. Meta-atoms are LCR circuits having strong resonant behavior over some chosen bandwidth. The distribution of many such atoms and their mutual interaction determine the bulk metamaterial's properties. Describing these properties draws from electromagnetics, antenna design, atomic and molecular physics and condensed matter physics. At increasingly small scales (i.e., at the nanoscale), both quantum and plasmonic phenomena can play a role.

OPTI 6205. Advanced Optical Materials. (3) Cross-listed Course(s): OPTI 8205. Prerequisite(s): OPTI 6104 and OPTI 6105; or ECGR 6133 or ECGR 8133. Molecular optical materials including fabrication methods. Luminescence centers; quenching. Nonlinear optics, including higher order terms of the susceptibility tensor. Photonic crystals. Three lecture hours per week.

OPTI 6206. Physical Optics Design and Simulation. (3) Cross-listed Course(s): OPTI 8206. Prerequisite(s): OPTI 6106 or permission of instructor. Design and simulation of optical components and systems using scalar and vector wave propagation, diffraction, and interference. The course is intended to complement OPTI 6241, which focuses on optical lens and system design using geometrical ray-tracing.

OPTI 6211. Introduction to Modern Optics. (3) Cross-listed Course(s): OPTI 8211. Prerequisite(s): OPTI 6102 or permission of instructor. Fourier analysis and holography, Coherence. Introduction to light production and detection. Optical modulation, including EO effect, Kerr effect, amplitude modulation, magnetooptic effect, photoelastic effect, and acousto-optic effect. Introduction to nonlinear optics. Photonic switching. Three lecture hours per week.

OPTI 6212. Integrated Photonics. (3) Cross-listed Course(s): OPTI 8212. Prerequisite(s): OPTI 6102 and OPTI 6104. Theory and application of optical waveguides, free-space micro-optics, and integrated photonic devices. Fabrication and integration techniques, including motivations for choice of approach (hybrid vs. monolithic, materials, size, performance, etc). Modeling and simulation. Students will be required to work with mathematical packages such as Matlab and/or Mathematica to illustrate key concepts and to implement beam propagation/optical modeling simulations. Three lecture hours per week.

OPTI 6221. Optical Communications. (3) Cross-listed Course(s): OPTI 8221. Prerequisite(s): OPTI 6102 and OPTI 6103. Introduction to optical communications and basic communication block such as lasers, optical modulators, and optical transceivers. Review of fibers (attenuation, dispersions, etc.). Optical amplifiers. Passive and active photonic components such as tunable lasers and filters.

Coherent and incoherent detection. Signal processing, photonic switching, and point-to-point links / connections. Three lecture hours per week.

OPTI 6222. Optical Communication Networks. (3) Cross-listed Course(s): OPTI 8222. Prerequisite(s): OPTI 6221 or graduate standing in ECE, CS, or IT. Optical signal coding, multiplexing and de-multiplexing. Time-domain medium access (TDM (SONET) and TDMA), wavelength-division multiplexing (WDM and WDMA). Optical networks, add-drop multiplexing (OADM), switching and routing technologies, Dispersion management. Optical clock and timing recovery. Optical amplification, wavelength conversion, transport, and networking protocols. Broadband ISDN concepts. Access, metro, and long-haul network topologies. Three lecture hours per week.

OPTI 6241. Optical System Function and Design. (3) Cross-listed Course(s): OPTI 8241. Prerequisite(s): OPTI 6102. Advanced study of telescopes, microscopes, cameras, off-axis imaging systems, stops, apertures, multiple lenses, use and selection of ray trace computer codes. Three lecture hours per week.

OPTI 6242. Optical Propagation in Inhomogeneous Media. (3) Cross-listed Course(s): OPTI 8242. Prerequisite(s): OPTI 6102 and OPTI 6104. Advanced study of free space propagation, scattering, and scintillation of Gaussian and uniform beam waves. Random processes, weak fluctuation theory, propagation through complex paraxial optical systems.

OPTI 6244. High Speed Photonics and Optical Instrumentation. (3) Cross-listed Course(s): OPTI 8244. Prerequisite(s): OPTI 6103 and OPTI 6104. Study of instrumentation used for generation, detection, and manipulation of light in optical circuits. Topics include: ultrashort pulse generation, photon-phonon interactions, 2nd & 3rd harmonic generation, squeezed light, optical tweezers, OPO, electro-optic modulators, selective polarizers, optical switches, amplifiers, multiplexing and mixing schemes, and application of CCD and CMOS cameras and detectors. Three lecture hours per week.

OPTI 6261. Modern Coherence Theory. (3) Cross-listed Course(s): OPTI 8261. Prerequisite(s): OPTI 6102 and OPTI 6104. Stochastic processes. Second order coherence of scalar and vector wavefields, radiation and states of coherence. Quantum wavefields.

OPTI 6271. Advanced Physical Optics. (3) Cross-listed Course(s): OPTI 8271. Prerequisite(s): OPTI 6101, OPTI 6102, and OPTI 6104. Advanced study of electromagnetic wave propagation, stratified media, physics of geometrical optics, polarization and crystal optics, absorption and dispersion, interference, propagation and diffraction. Three lecture hours per week.

OPTI 6281. Modern Optics Laboratory. (3) Cross-listed Course(s): OPTI 8281. Prerequisite(s): OPTI 6102. Selected experiments in areas of modern optics such as fiber optics, interferometry, spectroscopy, polarization, optical metrology, and holography. Six laboratory hours per week.

OPTI 6301. Introduction to Instrumentation and Processing at the Nanoscale. (3) Cross-listed Course(s): OPTI 8301 and NANO 8101. Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering.

OPTI 6302. Nanoscale Phenomena. (3) Cross-listed Course(s): OPTI 8302, CHEM 6102, and NANO 8102. Nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions). Nanoscale mechanics. Nanotribology. Biological and biologically-inspired machines.

OPTI 6303. Collaborative Research Proposal. (3) Cross-listed Course(s): OPTI 8303 and NANO 8203. Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills.

OPTI 6341. Applied Quantum Mechanics. (3) Cross-listed Course(s): OPTI 8341 and PHYS 6141. Principles of non-relativistic wave mechanics. The Schrodinger equation, linear harmonic oscillator and WKB approximation. Central forces and angular momentum. The hydrogen

atom. Applications of quantum mechanics in materials and optics.

OPTI 6371. Solid State Materials. (3) Cross-listed Course(s): ECGR 6132, ECGR 8132, OPTI 8371, and PHYS 6271. Crystal structure. Electromagnetic, electron, mechanical, and elastic wave interactions with crystals. Theory of X-ray diffraction. Energy band theory of metals and semiconductors. Optical properties of solids, phase transitions, and amorphous solids. Quantum mechanics of covalent bonding, phonon excitation, and thermal energy.

OPTI 6381. Engineering Metrology. (3) Cross-listed Course(s): MEGR 6181, MEGR 8181, and OPTI 8381. Introduction to metrology and standards. Uncertainty, precision and accuracy in metrology. Measurement of size and form, computational methods in measurement of form. Measurement of surface texture and out of roundness. Machine tool and robot accuracy and calibration. Evaluation of screw threads and gears. Introduction to design of precision instruments.

OPTI 6384. Advanced Surface Metrology. (3) Cross-listed Course(s): MEGR 7284, MEGR 8284, and OPTI 8384. Prerequisite(s): OPTI 6381, OPTI 8381, or permission of instructor. Constituents of surface texture, stylus, optical, atomic force microscope and other advanced methods of measuring surface texture. Two and three dimensional measurement of surfaces. Separation of form, waviness and roughness. Random process analysis techniques, use of transforms for filtering. Numerical evaluation of surface texture. Use of surface texture as fingerprint of the process. Relationship between function and surface texture.

OPTI 6400. Industrial Internship. (1 to 3) Cross-listed Course(s): OPTI 8400. Prerequisite(s): Completion of nine hours of graduate coursework and permission of program director. Full- or part-time academic year internship in optical science/optical engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Requires a mid-term report and final report to be graded by the supervising faculty. *May be repeated for credit.*

OPTI 6610. Seminar. (1) Cross-listed Course(s): OPTI 8610. Utilizing library resources, materials, and research tools. Using presentation software and developing presentation skills for effective technical presentations. Patents and technology transfer. Ethical issues in science and engineering. Current topics in optics.

OPTI 6611. Graduate Colloquium. (1) Cross-listed Course(s): OPTI 8611. Students present seminars on current topics in optical science and engineering. *May be repeated for credit.*

OPTI 6800. Independent Study. (1 to 3) Cross-listed Course(s): OPTI 8800. Prerequisite(s): Permission of the Optics Program Director. Independent study pursued by the student, or a group of students, under the direction of a professor. *May be repeated for credit up to 6 credits.*

OPTI 6991. Thesis Research. (1 to 3) Research for the thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit.*

OPTI 8000. Selected Topics in Optics. (3) Cross-listed Course(s): OPTI 6000. Prerequisite(s): Permission of Optics Program Director. Selected topics in optics from areas such as medical optics, adaptive optics, all optical networks, etc. *May be repeated for credit with change of topic.*

OPTI 8101. Mathematical Methods of Optical Science and Engineering. (3) Cross-listed Course(s): OPTI 6101. A comprehensive look at those mathematical techniques important to the understanding of optical phenomena. Includes vector algebra and calculus, matrix theory, Fourier series and transforms, complex analysis, solution of boundary value problems in partial differential equations, and special functions. Topical coverage emphasizes applications specific to the field of optics.

OPTI 8102. Principles of Geometrical Optics. (3) Cross-listed Course(s): OPTI 6102. Law of reflection and refraction, reflection and refraction at plane surfaces, paraxial imagery, mirrors, thick lenses, thin lenses, lens systems, stops, principle planes, the optical variant, vignetting, paraxial radiometry, analysis of common optical systems, real ray tracing, and introduction to aberrations and image resolution in the context of the modulation transfer function.

OPTI 8102L. Geometrical Optics Lab. (1) Cross-listed Course(s): OPTI 6102L. Selected experiments in areas of geometrical optics such as index of refraction measurement, dispersing and reflecting prisms, spherical mirrors and thin lenses, imaging, optical instruments, aberration, fiber optics, and fringe projection profilometry.

OPTI 8103. Light Sources and Detectors. (3) Cross-listed Course(s): OPTI 6103. Photon statistics and thermal light. Interactions of photons with atoms. Population inversion, lasing threshold, and resonator modes. Mode-locked and Q-switched lasers. Semiconductor photon sources including light-emitting diodes (LEDs) and laser diodes. Quantum-confined structures, materials, and devices. Thermal sources. Light extraction. Light detectors including photoconductive, photovoltaic and avalanche photodiodes. Noise in light sources and detectors.

OPTI 8104. Electromagnetic Waves. (3) Cross-listed Course(s): OPTI 6104. Optical phenomena that are explicitly associated with the electromagnetic nature of light. Includes an introduction to Maxwell's equations, and electromagnetic waves. Polarization and the Jones calculus. Energy and momentum conservation, boundary conditions and Fresnel equations. Waves in anisotropic (birefringent) and complex media. Modulation and deflection of optical beams (principles of acousto-optics and electro-optic devices). Propagation at interfaces, waveguides, and plasmons. Electromagnetic potentials and multipole radiation, scattering of light, and interaction with metallic nanoparticles.

OPTI 8105. Optical Properties of Materials. (3) Cross-listed Course(s): OPTI 6105. Electromagnetic wave propagation in dielectrics, semiconductors and metals. Dipole oscillator model, complex dielectric constants, and Kramers-Kronig relationship. Crystal structures and optical anisotropy. Reciprocal space and density of states. Electronic band structure. Quantum theory of radiative absorption and emission, selection rules. Direct and indirect interband absorption. Free-carrier absorption in metals and doped semiconductors. Free excitons and Frenkel excitons. Photo- and electroluminescence in semiconductors. Optical absorption and emission in quantum wells and quantum dots, and quantum Stark effect. Second and third-order optical nonlinearities.

OPTI 8106. Principles of Physical Optics. (3) Cross-listed Course(s): OPTI 6106. The Fourier transform and its role in wave optics. Wave properties of light, superposition of waves, angular spectrum of plane waves, relation to ray optics, Gaussian beams, periodic structures and surfaces, Fresnel diffraction, spatial filtering diffraction, interference and interferometers (two, multibeam, Fabry-Perot), polarization, temporal and spatial coherence, holography, imaging and resolution.

OPTI 8106L. Physical Optics Lab. (2) Cross-listed Course(s): OPTI 6106L. Selected experiments in areas of physical optics such as interference in thin films, Fabry-Perot, Michelson & Twyman-Green interferometers, polarization and diffraction of light. By the end of this course, students are asked to design and implement a mini project that includes geometrical and physical optics concepts.

OPTI 8201. Fourier Optics and Holography. (3) Cross-listed Course(s): OPTI 6201. Prerequisite(s): OPTI 8102 and OPTI 8104. Principles of scalar, Fresnel, and Fraunhofer diffraction theory. Coherent optical data processing. Optical filtering and data processing. Holography. Three lecture hours per week.

OPTI 8202. Fundamentals of Biomedical Optics. (3) Cross-listed Course(s): OPTI 6202 and PHYS 6202. Basic principles underlying tissue optics, laser-tissue interactions, and optical imaging, microscopy, and spectroscopy for medical applications.

OPTI 8203. Metamaterials. (3) Cross-listed Course(s): OPTI 6203. Metamaterials describes a new field of engineered materials having subwavelength structures, and which have electromagnetic properties not found in nature. Examples include zero and negative index materials which lead to some new applications. Metamaterials are made from "meta-atoms" which are much smaller than the wavelength of the radiation. Meta-atoms are LCR circuits having strong resonant behavior over some chosen bandwidth. The distribution of many such atoms and their mutual interaction determine the bulk metamaterial's properties. Describing these properties draws from electromagnetics, antenna design, atomic and molecular physics and condensed matter physics. At increasingly small scales (i.e., at the nanoscale), both quantum and plasmonic phenomena can play a role.

OPTI 8205. Advanced Optical Materials. (3) Cross-listed Course(s): OPTI 6205. Prerequisite(s): OPTI 8104 and OPTI 8105; or ECGR 6133 or ECGR 8133. Molecular optical materials including fabrication methods. Luminescence centers; quenching. Nonlinear optics, including higher order terms of the susceptibility tensor. Photonic crystals. Three lecture hours per week.

OPTI 8206. Physical Optics Design and Simulation. (3) Cross-listed Course(s): OPTI 6206. Prerequisite(s): OPTI 8106 or permission of instructor. Design and simulation of optical components and systems using scalar and vector wave propagation, diffraction, and interference. The course is intended to complement OPTI 8241, which focuses on optical lens and system design using geometrical ray-tracing.

OPTI 8211. Introduction to Modern Optics. (3) Cross-listed Course(s): OPTI 8211. Prerequisite(s): OPTI 6102 or permission of instructor. Fourier analysis and holography, Coherence. Introduction to light production and detection. Optical modulation, including EO effect, Kerr effect, amplitude modulation, magnetooptic effect, photoelastic effect, and acousto-optic effect. Introduction to nonlinear optics. Photonic switching. Three lecture hours per week.

OPTI 8212. Integrated Photonics. (3) Cross-listed Course(s): OPTI 6212. Prerequisite(s): OPTI 8102 and OPTI 8104. Theory and application of optical waveguides, free-space micro-optics, and integrated photonic devices. Fabrication and integration techniques, including motivations for choice of approach (hybrid vs. monolithic, materials, size, performance, etc). Modeling and simulation. Students will be required to work with mathematical packages such as Matlab and/or Mathematica to illustrate key concepts and to implement beam propagation/optical modeling simulations. Three lecture hours per week.

OPTI 8221. Optical Communications. (3) Cross-listed Course(s): OPTI 6221. Prerequisite(s): OPTI 8102 and OPTI 8103. Introduction to optical communications and basic communication block such as lasers, optical modulators, and optical transceivers. Review of fibers (attenuation, dispersions, etc.). Optical amplifiers. Passive and active photonic components such as tunable lasers and filters. Coherent and incoherent detection. Signal processing, photonic switching, and point-to-point links / connections. Three lecture hours per week.

OPTI 8222. Optical Communication Networks. (3) Cross-listed Course(s): OPTI 6222. Prerequisite(s): OPTI 8221. Optical signal coding, multiplexing and de-multiplexing. Time-domain medium access (TDM (SONET) and TDMA), wavelength-division multiplexing (WDM and WDMA). Optical networks, add-drop multiplexing (OADM), switching and routing technologies, Dispersion management. Optical clock and timing recovery. Optical amplification, wavelength conversion, transport, and networking protocols. Broadband ISDN concepts. Access, metro, and long-haul network topologies. Three lecture hours per week.

OPTI 8241. Optical System Function and Design. (3) Cross-listed Course(s): OPTI 6241. Prerequisite(s): OPTI 8102. Advanced study of telescopes, microscopes, cameras, off-axis imaging systems, stops, apertures, multiple lenses, use and selection of ray trace computer codes. Three lecture hours per week.

OPTI 8242. Optical Propagation in Inhomogeneous Media. (3) Cross-listed Course(s): OPTI 6242. Prerequisite(s): OPTI 8102 and OPTI 8104. Advanced study of free space propagation, scattering, and scintillation of Gaussian and uniform beam waves. Random processes, weak fluctuation theory, propagation through complex paraxial optical systems.

OPTI 8244. High Speed Photonics and Optical Instrumentation. (3) Cross-listed Course(s): OPTI 6244. Prerequisite(s): OPTI 8103 and OPTI 8104. Study of instrumentation used for generation, detection, and manipulation of light in optical circuits. Topics include: ultrashort pulse generation, photon-phonon interactions, 2nd & 3rd harmonic generation, squeezed light, optical tweezers, OPO, electro-optic modulators, selective polarizers, optical switches, amplifiers, multiplexing and mixing schemes, and application of CCD and CMOS cameras and detectors. Three lecture hours per week.

OPTI 8261. Modern Coherence Theory. (3) Cross-listed Course(s): OPTI 6261. Prerequisite(s): OPTI 8102 and OPTI 8104. Stochastic processes. Second order coherence of scalar and vector wavefields, radiation and states of coherence. Quantum wavefields.

OPTI 8271. Advanced Physical Optics (3) Cross-listed Course(s): OPTI 6271. Prerequisite(s): OPTI 8101, OPTI 8102, and OPTI 8104. Advanced study of electromagnetic wave propagation, stratified media, physics of geometrical optics, polarization and crystal optics, absorption and dispersion, interference, propagation and diffraction. Three lecture hours per week.

OPTI 8281. Modern Optics Laboratory. (3) Cross-listed Course(s): OPTI 6281. Prerequisite(s): OPTI 8102. Selected experiments in areas of modern optics such as fiber optics, interferometry, spectroscopy, polarization, optical metrology, and holography. Six laboratory hours per week.

OPTI 8301. Introduction to Instrumentation and Processing at the Nanoscale. (3) Cross-listed Course(s): OPTI 6301 and NANO 8101. Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering.

OPTI 8302. Nanoscale Phenomena. (3) Cross-listed Course(s): OPTI 6302, CHEM 6102, and NANO 8102. Nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions). Nanoscale mechanics. Nanotribology. Biological and biologically-inspired machines.

OPTI 8303. Collaborative Research Proposal. (3) Cross-listed Course(s): OPTI 6303 and NANO 8203. Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their

abilities to present and defend ideas, and to improve oral and written communication skills.

OPTI 8341. Applied Quantum Mechanics. (3) Cross-listed Course(s): OPTI 6341 and PHYS 6141. Principles of non-relativistic wave mechanics. The Schrodinger equation, linear harmonic oscillator and WKB approximation. Central forces and angular momentum. The hydrogen atom. Applications of quantum mechanics in materials and optics.

OPTI 8371. Solid State Materials. (3) Cross-listed Course(s): ECGR 6132, ECGR 8132, OPTI 6371, and PHYS 6271. Crystal structure. Electromagnetic, electron, mechanical, and elastic wave interactions with crystals. Theory of X-ray diffraction. Energy band theory of metals and semiconductors. Optical properties of solids, phase transitions, and amorphous solids. Quantum mechanics of covalent bonding, phonon excitation, and thermal energy.

OPTI 8381. Engineering Metrology. (3) Cross-listed Course(s): MEGR 6181, MEGR 8181, and OPTI 6381. Introduction to metrology and standards. Uncertainty, precision and accuracy in metrology. Measurement of size and form, computational methods in measurement of form. Measurement of surface texture and out of roundness. Machine tool and robot accuracy and calibration. Evaluation of screw threads and gears. Introduction to design of precision instruments.

OPTI 8384. Advanced Surface Metrology. (3) Cross-listed Course(s): MEGR 7284, MEGR 8284, and OPTI 6384. Prerequisite(s): OPTI 6381, OPTI 8381, or permission of instructor. Constituents of surface texture, stylus, optical, atomic force microscope and other advanced methods of measuring surface texture. Two and three dimensional measurement of surfaces. Separation of form, waviness and roughness. Random process analysis techniques, use of transforms for filtering. Numerical evaluation of surface texture. Use of surface texture as fingerprint of the process. Relationship between function and surface texture.

OPTI 8400. Industrial Internship. (1 to 3) Cross-listed Course(s): OPTI 6400. Prerequisite(s): Completion of nine hours of graduate coursework and permission of program director. Full- or part-time academic year internship in optical science/optical engineering complementary to the major course of studies and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Requires a mid-term report and final report to be graded by the supervising faculty. *May be repeated for credit.*

OPTI 8610. Seminar. (1) Cross-listed Course(s): OPTI 6610. Utilizing library resources, materials, and research tools. Using presentation software and developing presentation skills for effective technical presentations. Patents and technology transfer. Ethical issues in science and engineering. Current topics in optics.

OPTI 8611. Graduate Colloquium. (1) Cross-listed Course(s): OPTI 6611. Students present seminars on current topics in optical science and engineering. *May be repeated for credit.*

OPTI 8800. Independent Study. (1 to 3) Cross-listed Course(s): OPTI 6800. Prerequisite(s): Permission of the Optics Program Director. Independent study pursued by the student, or a group of students, under the direction of a professor. *May be repeated for credit up to 6 credits.*

OPTI 8991. Dissertation Research. (1 to 3) Research for the dissertation. *Graded on a Satisfactory Progress/ Unsatisfactory Progress basis each term. May be repeated for credit.*

Organizational Science (OSCI)

OSCI 8000. Organizational Science Overview. (3) Cross-listed Course(s): PSYC 6000. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Provides broad overview of the field of Organizational Science including its historical foundations. Each week is a mini-seminar on a particular topic within the field.

OSCI 8001. Current Topics and Events in Organizational Science. (1) Cross-listed Course(s): PSYC 6001. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. New and innovative research and practice topics related to Organizational Science will be discussed / delivered / facilitated by student researchers, faculty and invited speakers. These "cutting edge" topics will span all of micro and macro organizational science and will change each semester. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

OSCI 8002. Ethics and Professional Issues in Organizational Science. (2) Cross-listed Course(s): PSYC 6002. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Discusses ethical standards in professional practice, testing, research; business ethics; expectations and problems confronting organizational science practitioners in industrial and professional organizations.

OSCI 8003. Writing and Publishing in Organizational Science. (1 to 3) Cross-listed Course(s): PSYC 6003. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Seminar to enhance effective

technical/scientific writing (e.g., learning APA style, presentation of statistical analyses) and understanding the publication process (e.g., selecting an appropriate outlet, preparing a manuscript, the review process). Students actively engage in writing, as well as the review process (as both a reviewer and author).

OSCI 8100. Organizational Science Lab. (1 to 2) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor and co-enrollment in OSCI 8000. Special topics seminar connected with the Organizational Science Overview course (typically taught by the same instructor). Topics cover the field of Organizational Science. Science/practice/research issues emphasized. The instructor determines whether the course is taken for a letter grade or Pass/Unsatisfactory.

OSCI 8102. Research Methodologies in Behavioral Sciences. (3) Cross-listed Course(s): HPSY 8102. Prerequisite(s): Admission to the Ph.D. in Organizational Science program, or by permission of instructor. This interdisciplinary course provides a broad overview of the major research methodologies and methodological considerations in the behavioral sciences. Using examples drawn from the literature, the course focuses on general principles and perspectives of social science research. Topics include: foundational concepts across the behavioral sciences (e.g., sampling, measurement, ethics, logic of hypothesis testing, etc.), and the evaluation of specific methodologies (e.g., experimentation, observation, survey, archival, epidemiological/ecological designs, etc.). Practical research considerations are also covered (e.g., basics of APA writing, IRB process and forms, data management and data cleaning, development of experimental protocols, etc).

OSCI 8103. Basic Quantitative Analyses for Behavioral Sciences. (3) Cross-listed Course(s): HPSY 8103. Prerequisite(s): OSCI 8102. Introduction to quantitative data analysis and interpretation. Focuses on the strategic application of the multiple regression and correlational framework (including specific instantiations such as ANOVA, path analyses, etc.) including the incorporation of manipulated or categorical independent and categorical dependent variables.

OSCI 8104. Advanced Quantitative Analyses for Behavioral Sciences. (3) Cross-listed Course(s): HPSY 8104. Prerequisite(s): OSCI 8103 or equivalent; admission to the Ph.D. in Organizational Science program; or permission of instructor. A topical course that focuses on selected advance quantitative analyses used within behavioral sciences. Topics may include: survival analysis, repeated measures analyses, latent model analyses, multi-level modeling, advanced categorical variable analyses, meta-analysis. *May be repeated for credit with change of topic.*

OSCI 8130. Social Psychology. (3) Cross-listed Course(s): PSYC 6130. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Human social behavior; topics include affiliation, person perception, conformity and attitudes.

OSCI 8205. Field and Lab Based Quantitative Research Methods. (3) Cross-listed Course(s): PSYC 6205. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examines quantitative approaches to Organizational Science research such as experimental designs, quasi-experimental designs, organizational surveys, longitudinal models and field research.

OSCI 8206. Qualitative Research Methods. (3) Cross-listed Course(s): PSYC 6206. Prerequisite(s): Full graduate standing in the Ph.D. program in Organizational Science or permission of instructor. Examines qualitative approaches to Organizational Science research such as focus groups, verbal protocol, interviewing, naturalistic observation, and content analysis.

OSCI 8207. Psychometrics. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Presents an introduction to classical and modern test theory and methods. Theoretical and statistical bases for the measurement of psychological constructs are covered including Classical True Score Theory, reliability and validity inferences, item response theory, scaling, and an introduction to factor analysis.

OSCI 8208. Advanced Qualitative Data Analysis. (3) Prerequisite(s): OSCI 8206 or permission of instructor. This course extends the foundational approaches presented in OSCI 8206 to provide advanced instruction on the assumptions, contingencies, techniques, and practices of computer-supported qualitative data analysis systems (CAQDAS). Students will work with several advanced software packages that facilitate the management, analysis, and display of qualitative data.

OSCI 8477. Organizational Science Practicum. (1 to 6) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Practical experience/Internship in an organizational setting. With permission from the program director, a research assistantship on a grant can fulfill this requirement. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

OSCI 8610. Micro Organizational Science I. (3) Cross-listed Course(s): PSYC 6610. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examines research, theory and application regarding individual differences (e.g., abilities,

personality), assessment (e.g., tests, inventories, interviews, assessment centers), criterion development (e.g., job analysis, performance models) and organizational staffing processes (i.e., recruitment, selection, basic legal concepts).

OSCI 8611. Macro Organizational Science I (3) Cross-listed Course(s): PSYC 6611. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examines research, theory and application on the following topics: motivation, communication systems and processes, stress, job design, leadership, employee attitudes and emotions, teamwork, and decision making.

OSCI 8620. Micro Organizational Science II. (3) Cross-listed Course(s): PSYC 6620. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examines research, theory and application regarding post-entry personnel issues such as training, performance management, performance appraisal, compensation, and employee socialization.

OSCI 8621. Macro Organizational Science II. (3) Cross-listed Course(s): PSYC 6621. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examines research, theory and application on the following topics: organizational development, organizational change, organizational climate, organizational culture, organizational theory, and relations between organizations and their environment.

OSCI 8630. Micro Seminar in Organizational Science. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examination of special topic(s) germane to Micro Organizational Science. The seminar may focus on one or a small number of topics salient to this area. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

OSCI 8640. Macro Seminar in Organizational Science. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examination of special topic(s) germane to Macro Organizational Science. The seminar may focus on one or a small number of topics salient to this area. Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit with change of topic.*

OSCI 8650. Research Methods Seminar in Organizational Science. (3) Cross-listed Course(s): PSYC 6650. Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Examination of special topic(s) germane to research methods in Organizational Science. The seminar may focus on one or a small number of topics that define this area (e.g., a data analytic technique, a methodological approach). Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit.*

OSCI 8899. Organizational Science Readings and Research. (1 to 3) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Research and/or reading on a topic agreed on by a student and a faculty member. These elective hours may also be used toward the Graduate School's 18-credit hour dissertation research requirement once 12 dissertation credit hours (6 from OSCI 8998 and 6 from OSCI 8999) are met. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

OSCI 8948. Independent Pre-Doctoral Organizational Science Research Project I. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Identification of a focused research question and development of a research proposal comparable in scope to a Master's thesis. Conducted under the direction of a research chair and committee. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

OSCI 8949. Independent Pre-Doctoral Organizational Science Research Project II. (3) Prerequisite(s): OSCI 8948 and Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Research and defense of on an Independent Pre-Doctoral Research Project conducted under the direction of a research chair and committee. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.*

OSCI 8998. Organizational Science Dissertation I. (6) Prerequisite(s): Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Identification of a research question and development of the proposal for a research study appropriate a dissertation project. Conducted under the direction of a research chair and committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

OSCI 8999. Organizational Science Dissertation II. (6) Prerequisite(s): OSCI 8998 and Full graduate standing in the Ph.D. in Organizational Science program or permission of instructor. Research and defense of on an Independent Dissertation Project conducted under the direction of a research chair and committee. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit.*

Philosophy (PHIL)

PHIL 5050. Topics in Philosophy. (1 to 3) Prerequisite(s): Permission of the department. In-depth treatment of selected problems and issues in philosophy. *May be repeated for credit with change of topic.*

PHIL 6050. Topics in Philosophy. (1 to 3) Prerequisite(s): Permission of the department. In-depth treatment of selected problems and issues in philosophy. *May be repeated for credit with change of topic.*

PHIL 6110. Ethical Theory. (3) Examination of major normative and meta theories that undergird our practical judgments about morally right actions and morally good persons, organizations, or policies. This examination may include central problems and issues concerning morality's: requirements (e.g., utility, duty, virtue, care), authority (e.g., absolutism, relativism, pluralism, multiculturalism), scope (e.g., deceased or future human beings, animals, environment), justification (e.g., rationality, intuition), source (e.g., reason, sentiment, disagreement), and nature (e.g., realism/antirealism, objectivity/subjectivity).

PHIL 6120. Philosophical Methods and Analysis. (3) Explores the distinctive and various methods within philosophy (logical, phenomenological, feminist, conceptual, linguistic, deconstructive, and others), their uses in particular contexts (including links to other disciplines), and how methodology shapes philosophy (including its social impact). One aim is to clarify "applied philosophy" by examining its methods. Students analyze, evaluate, reconstruct, and originate arguments, judgments, and decisions. They do so in connection with both texts shared among all the students in the class and the particular interests of individual students. Each student develops a paper over the course of the semester to bring these issues together.

PHIL 6190. Supervised Teaching. (1) Offers an opportunity to work closely with a faculty member and to engage in supervised teaching as a form of applied philosophy exploring pedagogical practices, theories, issues, and educational research within the philosophy classroom. Normally connected with a graduate assistantship.

PHIL 6210. Ethics and Aesthetics. (3) Art often generates ethical conflicts because of its forms, content, or functions in society, and ethical debates are sometimes played out through art, so ethics and aesthetics are deeply intertwined. In turn, aesthetics has been strongly tied to politics. The course will cover a range of ethical/political issues in aesthetics across various arts (visual arts, film, music, literature, etc.), including readings from classical and contemporary authors such as Plato, Hume, Kant, Nietzsche, Adorno, Said, Nussbaum, and Piper.

PHIL 6220. Health Law and Ethics. (3) This course interprets and uses the main normative principles of bioethics (autonomy, non-maleficence, beneficence and justice) to guide the practice of healthcare professionals and policymakers. It also increases understanding, interpretation, and monitoring of the impact of legal, regulatory, and political environments on healthcare organizations. Topics include: medical malpractice, Medicare and Medicaid law, informed consent, privacy and confidentiality, reproductive freedom, death and dying, pain and suffering, allocation of scarce medical resources, developments in genetics, and regenerative medicine.

PHIL 6230. Ethics, Biotechnology, and the New Genomics. (3) This course uses a range of normative theories (e.g., deontology, utilitarianism, virtue ethics, and feminist ethics) to assess the morality of developments in biotechnology and the new genomics. It also probes the ethical, legal, political, and social implications of genetically modifying food and animals, genetically enhancing human beings, extending the human life span, assisting human reproduction, creating chimeras, and fusing humans with machines.

PHIL 6240. Research Ethics in the Biological and Behavioral Sciences. (3) Cross-listed Course(s): GRAD 6240. Designed to identify the fundamental elements that characterize not only methodologically grounded but also morally appropriate scientific research. Class discussion and readings focus on key issues in biological and behavioral research including informed consent, privacy and confidentiality, risk-benefit assessments, mechanisms for protecting animal and human research subjects, international research, vulnerable populations, conflicts of interest and data management, publication ethics, intellectual property issues and the politics of research.

PHIL 6250. Ethics of Public Policy. (3) Examines the conceptual tools available in the development of policies, regulations and guidelines that are responsive to normative standards of character and conduct. The course will include discussion of ethical and political theory, as well as its intersection with policy-making at topics such as equity, efficiency, security, and liberty. Issues may include how specific policies express moral commitments and choices, how some policies favor certain values over others, as well as on issues such as whistle-blowing, "dirty hands" (doing wrong to do right), "many hands" (hiding accountability in bureaucracy) and professional incompetence.

PHIL 6260. Ethics and International Affairs. (3) The relations between nation states and other trans-national organizations are often assumed to be governed by realist power relations, and outside the scope of ethical

deliberation. In this course we will examine what sorts of ethical norms can or should be brought to bear on international relations. Possible topic areas include both theoretical issues such as the applicability of ethical theory to the behavior of trans-cultural and international issues, the appropriateness of "Western" ethical norms to the discussion; as well as more specific topics such as global hunger, uneven development more generally, arms proliferation, and environmental security.

PHIL 6310. Language and Violence. (3) Explores philosophical theories on the relationship between language and violence, on a continuum from subtle forms of covert personal violence to grievous forms of covert institutional violence.

PHIL 6320. Feminist Theory and Its Applications. (3) This course will cover feminist critiques of the philosophical canon, feminist approaches to philosophical problems (e.g., feminist ethics, feminist epistemology), and philosophical studies of topics related to gender, sexuality, and the intersection of these categories with race and class. Students will have the opportunity to investigate how feminist philosophy bears on their individual projects and areas of interest.

PHIL 6330. Race and Philosophy. (3) In this course, students will both study the role of race in the history of philosophy and examine, from a philosophical perspective, contemporary discourses of race and racism. Critical race theory and postcolonial theory will be studied, as well as their intersection with feminism, queer theory, among other critical political philosophies.

PHIL 6340. Philosophy of Mind. (3) Examines questions concerning the relationship between body and mind, the existence of other minds, the nature of consciousness, and the architecture of cognition. Approaches to these questions include traditional philosophical sources (emphasizing metaphysics and epistemology) and more recent developments in cognitive science (including the computational model of mind, mental representation, connectionist systems, and artificial intelligence). Also addressed are ethical and social issues involved in the design and implementation of intelligent systems. Inquiries bear on issue such as free will and determinism, emotion and reasoning, and the nature of rationality.

PHIL 6350. Philosophy of Technology. (3) Examines philosophical views on the nature of technology, focusing on its effects on society and nature. Computer technologies and other cases will be considered.

PHIL 6360. Philosophy of Education. (3) Exploration of modern philosophies of education, with a focus on the relationships between pedagogy and society.

PHIL 6410. Internship in Ethics and Applied Philosophy. (3) On-site work in ethics and applied philosophy. Site and workload to be determined in consultation with a business, agency, organization or association and one faculty-internship advisor. Provides practical and professional training experience under conditions that the University cannot duplicate.

PHIL 6800. Independent Study. (1 to 3) Prerequisite(s): Permission of the department. Directed individual study of a philosophical topic of special interest to the student. *May be repeated for credit up to 3 credits toward the Certificate in Applied Ethics and the M.A. in Ethics and Applied Philosophy programs.*

PHIL 6999. Master's Research Paper. (3) Prerequisite(s): Completion of 15 credit hours of PHIL graduate courses, and permission of department. Students begin with a previously submitted course paper and spend the semester revising it. The goal is for each student to produce a polished, professional paper worthy of submission to a philosophical journal. Additional reading and research on the topic is conducted, and multiple steps of revision and presentation of work in progress to the class are included. *May be repeated for credit with new material.*

PHIL 8050. Topics in Philosophy. (1 to 3) Prerequisite(s): Permission of the department. In-depth treatment of selected problems and issues in philosophy. *May be repeated for credit with change of topic.*

PHIL 8240. Research Ethics in the Biological and Behavioral Sciences. (3) Cross-listed Course(s): GRAD 8240. See course listing for PHIL 6240 for the course description.

Physics (PHYS)

PHYS 5000. Selected Topics in Physics. (0 to 4) Prerequisite(s): Permission of instructor. Selected advanced topics in physics. *May be repeated for credit with permission of department.*

PHYS 5151. Thermal Physics. (3) Cross-listed Course(s): PHYS 4151. Prerequisite(s): PHYS 3101 and PHYS 3141 with grades of C or above; and CHEM 1251, CHEM 1251L, and MATH 2241. An introduction to heat, thermodynamics, kinetic theory, and statistical physics. Topics include: classical thermodynamics, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions. Three lecture hours per week.

PHYS 5181. Solid State Physics. (3) Cross-listed Course(s): PHYS 4181. Prerequisite(s): PHYS 3141 or permission of department. An introduction to solid-state physics. Topics include: crystal structures, reciprocal lattices, phonons, free

electron Fermi gases, band structures, and electrical, magnetic, and optical properties of metals, semiconductors, and insulators.

PHYS 5220. Computational Methods in Physics. (3) Prerequisite(s): Permission of instructor. Use of computers in solving physics problems including computational and mathematical methods to solve problems in classical mechanics, quantum mechanics, electromagnetism, nuclear physics, optics, and solid state physics. Computer solutions include numerical methods of integration, solving differential equations, curve fitting, and statistical analysis in physics.

PHYS 5222. Classical Mechanics II. (3) Prerequisite(s): PHYS 3121 and MATH 2241. Continuation of PHYS 3121. The second course of a two-semester sequence treating particle dynamics, the motion of systems of particles, rigid body motion, moving coordinate systems, Lagrange's equations, Hamilton's equations, and small oscillations. Three lecture hours a week.

PHYS 5232. Electromagnetic Theory II. (3) Prerequisite(s): PHYS 4231. Continuation of PHYS 4231. The second course in a two-semester sequence. Topics include: magnetostatics in free space and in matter, electromagnetic induction, vector and scalar potentials, magnetic properties of materials, Maxwell's equations in free space and in matter, propagating electromagnetic waves, and boundary value problems. Three lecture hours a week.

PHYS 5242. Modern Physics II. (3) Prerequisite(s): PHYS 4241. An extension of PHYS 4241 to include more advanced topics such as generalized eigenvalue problems, angular momentum, spin, the hydrogen atom, and perturbation theory, with selected applications from atomic, solid state, and nuclear physics. Three lecture hours a week.

PHYS 5271. Waves and Optics. (3) Cross-listed Course(s): OPTI 5371. Prerequisite(s): PHYS 2102 with a grade of C or above, and MATH 2171; or permission of instructor. Topics include: the mathematics of wave motion, light as an example of an electromagnetic wave, the superposition of periodic and non-periodic waves, and selected topics from geometrical and physical optics.

PHYS 5350. Teaching and Learning Physics. (3) Prerequisite(s): PHYS 2102 or permission of instructor. A course on how people learn and understand key ideas related to physics. Course focus includes physics content, pedagogical methods and curriculum, cognitive science, and physics education research. Course includes opportunities for teaching and individualized projects.

PHYS 6000. Selected Topics in Physics. (0 to 4) Prerequisite(s): Permission of instructor. Selected advanced topics in physics. *May be repeated for credit with permission of department.*

PHYS 6101. Biophysics. (3) Prerequisite(s): Permission of instructor. Principles of physics relevant to biological media; electrical activity, optical microscopy, and spectrophotometry. Photosynthesis and light absorption. Models of blood flow and the cardiovascular system. Dynamics of membrane lipids and ionic flow. Visual and audio systems. Radiation biophysics, ultrasonic interaction in biological media. Credit cannot be awarded for both PHYS 6101 and 8101.

PHYS 6121. Classical Dynamics. (3) Prerequisite(s): PHYS 4222. Variational principles and Lagrange's equations. Hamilton's principles and mechanics of particles. The two-body central force problem. Rigid body motion. Small oscillations and the eigenvalue equation.

PHYS 6131. Classical Electromagnetism I. (3) Prerequisite(s): PHYS 4232. Electrostatic and boundary value problems. Multipole expansions, dielectrics and magnetostatics. Maxwell's equations, time varying fields and conservation laws. Plane electromagnetic waves and wave propagation. Wave guides and resonant cavities. Simple radiating systems. Scattering and diffraction theory.

PHYS 6132. Classical Electromagnetism II. (3) Prerequisite(s): PHYS 6131. Special theory of relativity. Dynamics of relativistic particles and electromagnetic fields. Charged particle collisions and scattering. Radiation by moving charges. Bremsstrahlung, virtual quanta, and beta decay theory. Multipole expansions and fields. Radiation damping. Self-fields of particles. Scattering and absorption of radiation by a bound system.

PHYS 6141. Quantum Theory I. (3) Cross-listed Course(s): OPTI 6341 and OPTI 8341. Prerequisite(s): PHYS 4242. Principles of non-relativistic wave mechanics. The Schrodinger equation, linear harmonic oscillator and WKB approximation. Central forces and angular momentum. The hydrogen atom.

PHYS 6142. Quantum Theory II. (3) Prerequisite(s): PHYS 6141. Scattering theory, linear vector spaces, spin, two level systems. Quantum dynamics, symmetry operations, bound state and time-dependent perturbation theory. Theory of scattering, angular momentum, and identical particles.

PHYS 6201. Fourier Optics. (3) Prerequisite(s): PHYS 4271 or permission of instructor. Principles of scalar, Fresnel, and Fraunhofer diffraction theory. Coherent optical imaging systems, optical filtering, optical data processing, and holography. Application of Fourier optics and holography.

PHYS 6202. Fundamentals of Biomedical Optics. (3) Cross-listed Course(s): OPTI 6202. Basic principles underlying tissue optics, laser-tissue interactions, and optical imaging, microscopy, and spectroscopy for medical applications.

PHYS 6203. Methods of Molecular Modeling and Simulation in Physics. (3) Prerequisite(s): Permission of instructor. Numerical methods. Atomic models of soft-matter systems: liquids, polymers, and biomolecules. Molecular dynamics and Monte Carlo methods. Inter-particle potentials. Methods of efficient conformational sampling. Free energy calculations. Introduction to fundamental methods of molecular simulations designed to characterize and predict properties of microscopic systems in materials, physics, and biology. Classical simulations and their connection to experimentally measurable properties. (*Spring, On demand*)

PHYS 6210. Theoretical Physics. (3) Prerequisite(s): Permission of department. Topics include: Matrices, power series, solutions to ordinary and partial differential equations, Hilbert space, Fourier integrals, boundary value problems, Green's functions, and complex analysis.

PHYS 6211. Introduction to Modern Optics. (3) Prerequisite(s): PHYS 4271 or permission of department. Theory of laser oscillation, optical resonators, interaction of radiation and atomic systems, giant pulsed lasers, laser systems. Wave propogation in nonlinear media, modulation of optical radiation, noise in optical detection and generation. Interaction of light and sound. Laser types and applications including the free-electron laser.

PHYS 6220. Computational Methods in Physics. (3) Prerequisite(s): PHYS 6210. Use of computers in solving physics problems including computational and mathematical methods to solve problems in classical mechanics, quantum mechanics, electromagnetism, nuclear physics, optics, and solid state physics. Computer solutions include numerical methods of integration, solving differential equations, curve fitting, and statistical analysis in physics.

PHYS 6221 Optical Communications I. (3) Prerequisite(s): Prerequisite(s): PHYS 4242, PHYS 6241, or ECGR 5165. Introduction to optical communications. Optical waveguides (attenuation, dispersions, etc.). Basic communication blocks such as lasers, optical modulators, and optical transceivers. Passive and active photonic components such as tunable lasers, optical amplifiers, SOAs, l-converters, and filters. Coherent and incoherent detection. Signal processing, photonic switching, and point-to-point connections. Three lecture hours per week.

PHYS 6241. Light Sources and Detectors. (3) Prerequisite(s): PHYS 4241 or permission of department. Wave nature of light, basic semiconductor properties, light sources, light detectors and modulators, optical waveguides, optical systems with applications, and selected topics in nonlinear optics.

PHYS 6251. Statistical Physics. (3) Prerequisite(s): Permission of instructor. Classical and quantum statistical mechanics. Statistical thermodynamics. Ensembles, partition functions, fluctuations, ideal Fermi and Bose gas systems.

PHYS 6261. Nuclear Physics. (3) Prerequisite(s): Permission of instructor. A study of the nucleus, radioactivity, nuclear reactions, fission, fusion, interactions of radiation with matter and measurement of radiation.

PHYS 6271. Advanced Solid State Physics. (3) Cross-listed Course(s): ECGR 6132, ECGR 8132, OPTI 6371, and OPTI 8371. Prerequisite(s): Permission of instructor. Crystal structure. Electromagnetic, electron, mechanical, and elastic wave interactions with crystals. Theory of X-ray diffraction. Energy band theory of metals and semiconductors. Optical properties of solids, phase transitions, and amorphous solids. Quantum mechanics of covalent bonding, phonon excitation, and thermal energy.

PHYS 6281. Modern Optics Laboratory. (3) Prerequisite(s): PHYS 3281 or permission of instructor. Selected experiments in such modern optics areas as fiber optics, holography, spectroscopy, and Fourier optics. Six laboratory hours each week.

PHYS 6991. Physics Thesis Research I. (1 to 3) Prerequisite(s): admission to candidacy and permission of instructor. Research for the thesis. Letter grade assigned. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 6 credit hours.*

PHYS 6992. Physics Thesis Research II. (1 to 4) Prerequisite(s): PHYS 6991 and permission of instructor. Research for the thesis. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 4 credit hours.*

Public Policy (PPOL)

PPOL 8000. Topics in Public Policy. (1 to 4) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Study of selected topics in Public Policy. *May be repeated for credit.*

PPOL 8101. Public Policy Studio I: Data Management and Basic Analytics. (3) Prerequisite(s): Admission to the Ph.D. in Public Policy or Graduate Certificate in Public Policy

Research and Analysis. Hands-on data management and analysis skills through project-based learning. Students learn to formulate a data management plan and undertake the steps necessary to ensure that data is properly processed and analyzed. Students also learn how to interpret data and develop policy recommendations. This course prepares students for regression analysis so they clearly understand all steps that must be taken before running a regression, including proper conceptualization and operationalization of variables.

PPOL 8102. Public Policy Studio II: Applied Research and Regression Analysis. (3) Prerequisite(s): GRAD 8101; PPOL 8101; and admission to the Ph.D. in Public Policy or Graduate Certificate in Public Policy Research and Analysis. Provides hands-on research experience through project-based learning. Students conduct guided independent research. They also conduct a literature review to develop research questions and hypotheses; identify a secondary dataset that is appropriate for testing their hypotheses; employ the R statistical software package to manage the entire research process for secondary data analysis; interpret regression analysis; and develop policy recommendations. Each step in the process is completed in the classroom where faculty can work with students. Gaps in knowledge are addressed through short lectures, as necessary.

PPOL 8600. Policy Process I. (3) Prerequisite(s): Prior coursework or experience relevant to political and legal processes, behaviors, and institutions. This is a Core Course in the Ph.D. in Public Policy program. Examination of the field of public policy analysis to include both theory and practice. Process includes everything from sources of public problems to feedback mechanisms after policy implementation. Emphasis on the policy process in growing urban regions and the ability to communicate with stakeholders to determine value conflicts and to communicate policy solutions. Examination of the context (legal, institutional, historical, philosophical, social, political, physical and spatial) within which policy is made with sensitivity to gender, race and ethnicity, and class concerns.

PPOL 8602. Research Design in Public Policy. (3) This is a Core Course in the Ph.D. in Public Policy program. Introduces students to various quantitative and qualitative approaches to doing policy research. Considers such major issues in philosophy of science as causality, measurement, and post-positive approaches to research. Students may use the course to prepare their dissertation proposals or research grant and contract proposals.

PPOL 8610. The Urban Region. (3) Cross-listed Course(s): GEOG 6123 and GEOG 8123. Prerequisite(s): Prior coursework or experience relevant to the nature of urban regions. Examination of the nature of urban regions. The basic factors that shape urban regions as they grow. Impact of: geography; history; social factors; economic factors; concerns about gender, race and ethnicity, and class; and other determinants of the nature of urban regions, their problems, and possible policy solutions.

PPOL 8611. Metropolitan Governance and Administration. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Introduction of major issues in urban politics and related trends and problems in urban governance and administration.

PPOL 8612. Theory of Urban Development. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Analysis of urban economics and politics within the context of public policy and planning. Focuses on theory and application to understand the rationale for and effects of urban policy, urban economic development, and planning. Provides basic understanding of the operation of urban real estate markets and the motivation for public sector interventions. Applies theoretical foundations to the study of current urban problems and controversies. Familiarity with introductory microeconomics is required.

PPOL 8613. Transportation Policy. (3) Cross-listed Course(s): GEOG 6600 and GEOG 8600. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines surface transportation from a broad public policy perspective with a special focus on its institutional components and the changing role of government in transportation policy-making including the evolution of, and relationships among, various federal, state and local policies that affect investment decisions in transportation infrastructure.

PPOL 8614. Colloquium in 20th Century Black Urban History. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examination of major and topical monographic works in African American urban history during the twentieth century. The focus will be on such topics as" classical urban examinations by black scholars, ghettoization and alternative theories, community and its institutions, riot sand urban rebellions, biography, black mayors, and urban policy.

PPOL 8615. The Restructuring City. (3) Cross-listed Course(s): GEOG 6210 and GEOG 8210. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. This course places at center stage the causes and consequences of contemporary urban restructuring and evaluates the theoretical, planning, and policy challenges inevitably presented.

PPOL 8616. Urban Planning Theory and Practice. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Alternative planning theories and application of theories in urban planning practices.

PPOL 8617. Law and Management. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Constitutional and administrative law issues, including a survey of academic debates over contested issues, and selected areas in constitutional law on civil liberties and civil rights.

PPOL 8618. Growth Management Systems. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Exploration of growth management programs, legal and planning issues, and legislation to determine their merits, weaknesses and abilities to promote more sustainable development patterns. Will emphasize difficulty of changing traditional procedures of development and land use.

PPOL 8622. Qualitative Methods in Public Policy. (3) Advanced qualitative methods as applied to analysis and solution of public problems. Use of qualitative methods to analyze public problems; to devise appropriate, effective, acceptable public policies; to evaluate public programs; and to present the results of qualitative analysis to appropriate audiences.

PPOL 8625. Advanced Seminar in Spatial Decisions Support Systems. (3) Prerequisite(s): GEOG 5120 or permission of instructor. Theoretical aspects of spatial DSS including technical, social, political and psychological considerations; system s design; systems manipulation; and case studies. Three hours of lecture and one-two hour lab per week.

PPOL 8630. Advanced Program Evaluation. (3) This is a CORE course in the Ph.D. in Public Policy program. Development and application of policy analysis to the evaluation of existing public policies. Particular attention to the use of multiple techniques of analysis and presentation of program evaluations to relevant audiences.

PPOL 8635. Ethics of Public Policy. (3) This is a CORE course in the Ph.D. in Public Policy program. Ethical questions in the study, formation, implementation, and evaluation of public policies. Ethical dilemmas faced by the public policy analyst, and the importance of use of values analysis. Emphasis on understanding how values are communicated by a variety of stakeholders in policy systems and how communicating public policy solutions involves an understanding of the role of values in successful policy formation and implementation.

PPOL 8636. The Social Context of Mental Health. (3) Cross-listed Course(s): SOCY 6635, SOWK 6635, and PSYC 8636. Prerequisite(s): Admission to graduate program or permission of instructor. Draws upon contributions from the field of psychiatry, psychology, social work, and anthropology. Focuses on mental health and illness it is social context, with an emphasis on the relationship between social structure and mental health/disorder. Examines the social factors which shape psychiatric diagnosis, the effects of socio-demographic variables on mental health, and the role of social support and stress for different groups. Also examines the organization, delivery, and evaluation of mental health services, and mental healthcare policy.

PPOL 8640. Economic Analysis of Public Policy I. (3) This is a CORE course in the Ph.D. in Public Policy program. Economic role of government, efficiency versus equity, externalities, and public goods, market failures and government failures, economics of centralized versus decentralized decision making, public choice theory, economics of privatization, economic role of nonprofits and non-governmental organizations.

PPOL 8641. Economic Analysis of Public Policy II. (3) Prerequisite(s): PPOL 8640. This is a CORE course in the Ph.D. in Public Policy program. Economics of taxation and government borrowing, benefit-cost analysis, regional growth and development, econometric analysis of local and regional public policy issues.

PPOL 8642. Regional Economic Development. (3) Cross-listed Course(s): GEOG 6302, GEOG 6400, and GEOG 8302. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program; PPOL 8610; intermediate microeconomics; or permission of instructor. Course covers classical, neo-classical and contemporary theories of trade, economic geography, and regional development. Topics include: theories of urban and regional growth, location theories, human capital, labor force and entrepreneurial contributions to growth. Policy dimensions of urban growth and development are addressed from theoretical and empirical perspectives.

PPOL 8643. Rural Development Issues. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. This course provides research experiences that focus on policy formulation, and demographic, economic and planning issues in rural areas.

PPOL 8644. Public Budgeting and Financing. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Focus is on the public budget process as a means of policy development, analysis and implementation. It will also address in more depth issues of financing the policies authorized in the budget and for which appropriations are sought.

PPOL 8650. Environmental Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. This course draws upon concepts and tools from economics, geography, law, sociology, political science, and planning to explore the concept of sustainable development, a central tenet of environmental policy. Environmental policy will be analyzed within the federalist framework.

PPOL 8652. Energy and Environmental Economics. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Economics issues of both energy and environment. Energy issues include the historical development of energy resources, supply and demand considerations, and projections of the future energy balance. Environmental issues are externalities, common property resources, and government regulation. Policy considerations include environmental standards, pollution charges, and property rights. Cost-benefit analysis and microeconomic theory are applied.

PPOL 8653. Urban Air Quality. (3) Prerequisite(s): Ph.D. student and permission of instructor. Examination of the relationships between climatic processes and urban air quality with emphasis on trends and patterns. Topics will include health and environmental effects of air pollution, ozone climatology, pollutant transport, transportation related emissions, risk assessment, and air quality management.

PPOL 8655. Watershed Science Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examination of the cycling of water and chemical elements within forested, agricultural and urbanized watersheds. Land use regulations designed to protect water quality are examined with respect to hydrologic and biogeochemical process that operate at the watershed scale.

PPOL 8656. Earth Systems Analysis: Biogeochemical Cycles. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines the Earth's water and major elemental cycles including those of carbon, nitrogen, sulfur, phosphorus and the major crustal elements. Uncertainties in the current state of global elemental cycles are examined. Special emphasis is placed on how these cycles are currently being modified through human activities.

PPOL 8661. Social Organization of Healthcare. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Focuses on the structures and operations of healthcare institutions and providers. The topics covered include the socio-historical development of the existing healthcare system, healthcare occupations and professions, professional power and autonomy, professional socialization, inter-professional and provider-client relations, healthcare organizations, and how change affects the delivery of healthcare services.

PPOL 8663. Health Policy. (3) Cross-listed Course(s): HSRD 8204. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program and a graduate level course providing an adequate introduction to the U.S. healthcare system such as HADM 6100 or MPAD 6172, or permission of instructor. Examines the formulation, adoption, implementation, and evaluation of health policy at national, state, and local levels through extensive readings in relevant health and policy literatures.

PPOL 8665. Analytic Epidemiology. (3) Cross-listed Course(s): HCIP 6260 and HLTH 6260. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program; and HADM 6104 or permission of instructor. Practical experience in preparing, analyzing, and presenting findings from epidemiologic data in the form of a research report or a manuscript. Students critically examine different epidemiologic research designs, identify sources of error, and develop skills to use bivariate and multivariate approaches to analyze epidemiologic associations. Students are also introduced to sources of secondary datasets and use statistical software such as STATA, SAS to perform data analysis.

PPOL 8667. Economic of Health and Healthcare. (3) Cross-listed Course(s): ECON 6260 and HSRD 8203. Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program, PPOL 8640 and PPOL 8641 or permission of instructor. Uses economic theory and econometrics to analyze the functioning of the healthcare sector and appropriate public policy. Topics include: how markets for medical care differs from other markets, the demand for medical care, the demand and supply of health insurance, the role of competition in medical markets, managed care, managed competition, and the role of the public sector in regulating and financing healthcare.

PPOL 8669. Investigating Health and Health Services. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program, GRAD 8101, and GRAD 8103; or permission of instructor. How to conduct and evaluate research necessary to health policy. Students are expected to conduct research utilizing a variety of methodologies and learn how to access available secondary data sets relevant to healthcare and policy. Topics include: multidisciplinary collaboration, measurement of health related constructs and healthcare outcomes, and health evaluation (cost, quality, access). Students are expected to develop their dissertation proposals as one outcomes of this course. Designed to be a seminar, and active participation in class discussion and activities is essential.

PPOL 8671. Criminal Justice Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examination of the criminal justice subsystems (law enforcement, courts, corrections) with particular focus on the development of policy and the effectiveness of current policies aimed at reducing crime.

PPOL 8672. Theories of Crime and Justice. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Exposes students to mainstream and critical theoretical approaches to crime, justice, and criminal behavior. An emphasis on both broad conceptual orientations allows us to assess the development of criminology within an array of historical and philosophical contexts during the past three centuries.

PPOL 8673. Law and Social Control. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines how the criminal law functions as a powerful tool of social control in our society. Particular emphasis is given to understanding the constitutional limitations placed on construction of law, the elements of criminal offenses, and criminal defenses.

PPOL 8681. Race, Gender, Class, and Public Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. An overview of major theories, trends, and debates on the topic of gender, race and economic inequality in the contemporary United States.

PPOL 8682. Stratification and Social Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines: (a) structures and processes underlying social stratification in the United States, particularly the inequality that is grounded in social class, gender, ethnicity, and race; and (b) the social policy implications that follow from our analysis of the nature and sources of stratification.

PPOL 8683. Population Dynamics and Social Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Basic population characteristics, such as age distribution, life expectancy, fertility, and trends in these characteristics are relevant to nearly all social policy. An introduction to basic concepts and tools of demographic analysis and how they may be applied to the study of social policy including family policy, aging policy, and minority groups' policy.

PPOL 8685. Aging and Social Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Utilizes the concepts of social gerontology as a Springboard for examining social policy for an aging population. Examination of the public policy making process with attention to aging policy. Consideration of determinants of aging policy and institution and actors in the policy making process and piecemeal development of legislation analyzed as factors related to the making of policy for the aged.

PPOL 8687. Education Policy. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines equity, efficiency, and diversity tradeoffs among alternatives systems of delivering K-12 education. The course also examines how to evaluate educational policies and programs.

PPOL 8688. Political Economy of School Reform. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines between business leaders' vision for school reform and the school restructuring movement, the reforms which arise from their construction of the problem, local educational restructuring efforts within the context of the larger national reform movement, and the opportunities and dangers of corporate-inspired educational policies.

PPOL 8689. The Social Context of Schooling. (3) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. Examines the relationships among certain aspects of the contemporary social structure and educational processes and outcomes. It explores the ways that the social class structure, race, and gender stratification affect the ways individuals experience, understand, and acquire education.

PPOL 8690. Seminar in Public Policy. (1) Prerequisite(s): Full graduate standing in the Ph.D. in Public Policy program or permission of instructor. This is a CORE course in the Ph.D. in Public Policy program. Series of guest speakers and exercises on a range of policy issues. Designed to increase familiarity with the variety of topics and methods covered by policy making and analysis as well as career options. Student participation and oral critique of a selected speaker and their topic. *Must be repeated for credit for a total of 3 credits.*

PPOL 8701. Advanced Macroeconomic Theory. (3) Cross-listed Course(s): ECON 6201. Prerequisite(s): Admission to graduate program and permission of program director. Theories of aggregate income determination, inflation, unemployment, interest rates and economic growth; macro-economic consumption and investment behavior; the business cycle.

PPOL 8703. Advanced Microeconomic Theory. (3) Cross-listed Course(s): ECON 6202. Prerequisite(s): Admission to graduate program and permission of program director. Theories of the firm, of the consumer, and of resource owners; determination of prices under different market

structures; general equilibrium analysis and welfare economics.

PPOL 8705. Advanced Urban and Regional Economics. (3) Cross-listed Course(s): ECON 6250. Prerequisite(s): Admission to graduate program. Applications of microeconomic theory to problems of cities, metropolitan areas and regions; methods in regional analysis, location theory, land use planning, measurement of economic activity; transportation, housing, poverty, and growth issues.

PPOL 8707. Game Theory and Experiments. (3) Cross-listed Course(s): ECON 6206. Prerequisite(s): Permission of the Graduate Program Director. Focuses on game theoretic analysis and the experimental methodology which can be used to test game theoretic models. The primary topics in game theory include: static games with complete information, dynamic games with complete information, static games with incomplete information, and dynamic games with incomplete information. Some topics are introduced by way of an economic experiment, and the experiment is followed by a rigorous analysis of the game theoretic solution to the game. The latter part of the course focuses on how to design economic experiments as a means of testing the predictions of game theoretic models.

PPOL 8709. Public Economics. (3) Cross-listed Course(s): ECON 6256. Prerequisite(s): MATH 1241 or equivalent, and permission of the program director. Public economics is the study of the way governments choose spending, taxation, and regulatory policy; the ways such policies may affect economic welfare; and mechanisms to evaluate the economic effects of such policies.

PPOL 8711. Monetary and Financial Theory. (3) Cross-listed Course(s): ECON 6235. Prerequisite(s): ECON 6201 or ECON 6202; and ECON 6112 or equivalent. Theory and empirical tests of money supply, money demand, and financial markets; portfolio theory with special attention to portfolio choices of banks; term structure of interest rates; dynamic models of money and economic activity.

PPOL 8800. Independent Study. (1 to 3) Prerequisite(s): Permission of instructor and the program director. Supervised study of a public policy topic or problem of special interest to the student and within the instructor's expertise. *May be repeated for credit.*

PPOL 8801. Dissertation. (1 to 9) Prerequisite(s): Passage of qualifying examinations, and approval of dissertation topic by the student's advisory committee. In-depth study of a practical problem in public policy. Analysis of the problem, preparation of a policy solution, and presentation of the solution to appropriate stakeholders and the public. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit up to 18 credit hours.*

PPOL 8802. Independent Study II: Public Policy Research Experience. (3) Prerequisite(s): Permission of instructor and department to be obtained in the semester preceding the semester in which the course is to be taken. Guided research with a faculty mentor. Students gain hands-on research experience and may participate in research at the University or in the broader community under the guidance of a faculty mentor. *May be repeated for credit up to 6 credit hours.*

Psychology (PSYC)

PSYC 5001. Advanced Topics in Psychology. (3) A discussion of selected topics in psychology. *May be repeated for credit with change of topic.*

PSYC 5316. Cognitive Neuroscience. (3) Prerequisite(s): graduate standing or permission of instructor. Biological basis of consciousness and the neurobiology of mental processes by which we perceive, act, learn, and remember; representation of mental processes from electrophysiological and brain imaging techniques, clinical neurology, and computational science.

PSYC 6000. Organizational Science Overview. (3) Cross-listed Course(s): OSCI 8000. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Provides broad overview of the field of Organizational Science including its historical foundations. Each week is a mini-seminar on a particular topic within the field.

PSYC 6001. Current Topics and Events in Organizational Science. (1) Cross-listed Course(s): OSCI 8001. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. New and innovative research and practice topics related to Organizational Science will be discussed/delivered/facilitated by student researchers, faculty and invited speakers. These "cutting edge" topics will span all of micro and macro organizational science and will change each semester. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit.* .

PSYC 6002. Ethics and Professional Issues in Organizational Science. (2) Cross-listed Course(s): OSCI 8002. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Discusses ethical standards in professional practice, testing, research; business ethics; expectations and problems confronting organizational science practitioners in industrial and professional organizations.

PSYC 6003. Writing and Publishing in Organizational Science. (1 to 2) Cross-listed Course(s): OSCI 8003. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Seminar to enhance effective technical/scientific writing (e.g., learning APA style, presentation of statistical analyses) and understanding the publication process (e.g., selecting an appropriate outlet, preparing a manuscript, the review process). Students will actively engage in writing as well as the review process (as both a reviewer and reviewee).

PSYC 6010. Topics in Learning and Cognition. (3) An examination of selected topics in the areas of learning, memory and cognition, and behavior modification, with an emphasis on the applications to the areas of clinical, community and industrial psychology. *May be repeated for credit with permission of department.*

PSYC 6015. Topics in Perception and Physiological Psychology. (3) An examination of selected topics in the areas of sensation and perception, physiological and neuropsychology, with an emphasis on the applications to the areas of clinical, community, and industrial psychology. *May be repeated for credit with permission of department.*

PSYC 6020. Topics in Developmental Psychology. (3) An examination of selected topics in child and adult development, aging, and developmental disabilities, with an emphasis on the applications to the areas of clinical, community, and industrial psychology. *May be repeated for credit with permission of department.*

PSYC 6030. Topics in Social Psychology and Personality. (3) An examination of selected topics in personality and social psychology, with an emphasis on the applications to the areas of clinical, community, and industrial psychology. *May be repeated for credit with permission of department.*

PSYC 6050. Topics in Psychological Treatment. (3) Cross-listed Course(s): HPSY 8050. Prerequisite(s): PSYC 6151. A topical course which will focus on issues in treatment, alternative treatment perspectives, special client populations. *May be repeated for credit with permission of department.*

PSYC 6099. Topics in Psychology. (3) Cross-listed Course(s): HPSY 8099. A discussion of selected topics in psychology. *May be repeated for credit with change of topic.*

PSYC 6102. Organizational Research Methods. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Research design and the application of statistical methods to I/O research, with a specific focus on gathering and evaluating organizational data.

PSYC 6107. Ethical and Professional Issues in Psychology. (3) Cross-listed Course(s): HPSY 8107. Roles and responsibilities of psychologists, including ethical standards in professional practice, testing and research; expectations and problems confronting psychologists in industrial, clinical and professional organizations.

PSYC 6111. Psychology of Learning and Memory. (3) Principles, theories and current research in learning with emphasis on human learning and memory.

PSYC 6112. Applied Behavior Analysis. (3) Cross-listed Course(s): PSYC 8112. Use of behavior principles in applied settings. Topics include: behavioral assessment, positive and negative reinforcement, punishment, extinction, stimulus control, maintenance and generalization of behavior change. Each student will design and carry out a behavior change project.

PSYC 6113. Physiological Psychology. (3) The relationships between the nervous system and behavior. Topics include: the structure of the nervous system and nerve conduction, the functional organization of the central nervous system, neuronal and hormonal control of behavior, biofeedback and other appropriate topics.

PSYC 6115. Sensation and Perception. (3) Processes involved in receiving and interpreting sensory data including all the sensory systems with an emphasis on vision.

PSYC 6116. Cognition. (3) Concerned with how humans acquire information, retain information in memory, and use this information to reason and solve problems. Current emphases include memory, category learning, planning, concept formation, problem solving, mental models, and knowledge representation.

PSYC 6120. Developmental Psychology. (3) Psychological development across the lifespan.

PSYC 6124. Psychology of Aging. (3) Cross-listed Course(s): GRNT 6124. Psychology of aging with particular emphasis on issues related to community/clinical psychology and industrial/organizational psychology. Topics include: myths and stereotypes about aging, problems faced by older workers, retirement, mental health and normal aging, counseling the older adult, and psychological disorders in later life.

PSYC 6130. Social Psychology. (3) Cross-listed Course(s): OSCI 8130. Human social behavior; topics include affiliation, person perception, conformity and attitudes.

PSYC 6135. Psychology of Personality. (3) A critical evaluation of major personality theories including an extensive survey of current research.

PSYC 6140. Psychological Measurement and Evaluation. (3) Prerequisite(s): PSYC 6102. Measurement of psychological characteristics; scaling, reliability, validity and norms; construction and use of the intelligence tests, personality inventories, interest tests, attitude scales, etc., interviewing, survey techniques and behavioral assessment.

PSYC 6141. Intellectual Assessment. (4) Cross-listed Course(s): HPSY 8141. Theories of intelligence and methods of intellectual assessment, including practice in administering intelligence tests, interpreting results, and writing evaluation reports. Three lecture hours and one two-hour lab per week.

PSYC 6142. Personality Assessment. (4) Cross-listed Course(s): HPSY 8142. Prerequisite(s): PSYC 6151, PSYC 6141, or permission of department. Theories and methods used in the assessment of personality and psychopathology, including practice in administering personality tests, interpreting results and writing evaluation reports. Three lecture hours and one two-hour lab per week.

PSYC 6145. Applied Research Design and Program Evaluation. (3) Cross-listed Course(s): HPSY 8145. Prerequisite(s): PSYC 6102. Models of evaluative research; also techniques, designs and administration of program evaluation. Topics include: role conflicts, entry issues, goal setting, research for program planning and implementation and examples of actual program design and evaluation.

PSYC 6150. Introduction to Psychological Treatment. (4) Cross-listed Course(s): HPSY 8150. Prerequisite(s): PSYC 6151. Major approaches to psychological intervention, including psychodynamic, behavioral, humanistic and cognitive-behavioral systems. Emphasis on practical therapy considerations, including crisis intervention, client behaviors at various stages of therapy, handling difficult clients and ethical and professional issues. Three lecture hours and one two-hour lab per week.

PSYC 6151. Behavior Disorders. (4) Cross-listed Course(s): HPSY 8151. Diagnostic systems in current use and the implications of these systems for psychologists; several perspectives on psychological processes, behavior disorders and diagnosis including psychodynamic, behavioral and social models; practice in diagnostic interviewing. Three lecture hours and one two-hour lab per week.

PSYC 6153. Classification of Psychological Dysfunctions. (3) Introduction to systems for classifying psychological disorders for counselors and review of current theoretical, experimental, and clinical perspectives on abnormal psychology, including the current Diagnostic and Statistical Manual of Mental Disorders. Credit will not be given for both PSYC 6153 and PSYC 6151.

PSYC 6155. Community Psychology. (3) Cross-listed Course(s): HPSY 8155. Research, intervention techniques and settings associated with major approaches in community psychology including the mental health, organizational, ecological, and social action models.

PSYC 6171. Industrial/Organizational Psychology. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Human behavior within organizations. Topics include: recruitment, hiring, competency modeling, talent management, leadership, job attitudes, and organizational development and change.

PSYC 6171L. Laboratory in Industrial/Organizational Psychology. (1) Corequisite(s): PSYC 6171. Practice in administration and scoring of surveys and tests. Experience in role plays, training practices, and interviews.

PSYC 6172. Talent Acquisition. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Issues associated with the attraction and evaluation of job applicants. Topics include: job analysis, testing in industry, interviews, personality measures, assessment centers, and managing the hiring process.

PSYC 6173. Job Attitudes. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. The individual within the organization, including job attitudes, engagement, and motivation.

PSYC 6174. Organizational Dynamics. (3) Prerequisite(s): PSYC 6171. Group processes, including group formation, group decision-making, leadership, and group structure.

PSYC 6175. Organizational Development and Change. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Organization theories and organizational change methods.

PSYC 6176. Counseling Psychology in Organizations. (3) Application of psychology to special problems within the organization, especially the counseling of employees experiencing life problems: for example, retirement, alcoholism, interpersonal conflict.

PSYC 6177. Talent Management. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor.

Theoretical bases of talent management. Topics include: performance appraisal, legal issues, succession planning, human resource planning, and training and development.

PSYC 6200. Health Psychology I. (3) Cross-listed Course(s): HPSY 8200. Intensive review of the contributions of the discipline of psychology to the promotion and maintenance of health, the prevention and treatment of illness, and the improvement of the healthcare system. Examines links between psychology and health by emphasizing interactions among biological, behavioral and social systems that impact health and illness experiences. Topics include: stress, coping, pain, chronic disease and psychoneuroimmunology. Emphasizes the relevance of age, gender, personality, and culture for understanding health-related behaviors.

PSYC 6202. Health Psychology II. (3) Cross-listed Course(s): HPSY 8201. Prerequisite(s): PSYC 6200. Continuation of Health Psychology I.

PSYC 6205. Field and Lab Based Quantitative Research Methods. (3) Cross-listed Course(s): OSCI 8205. Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Examines quantitative approaches to Organizational Science research such as experimental designs, quasi-experimental designs, organizational surveys, longitudinal models and field research.

PSYC 6206. Qualitative Research Methods. (3) Cross-listed Course(s): OSCI 8206. Prerequisite(s): Full graduate standing in a psychology graduate program or permission of instructor. Examines qualitative approaches to Organizational Science research such as focus groups, verbal protocol, interviewing, naturalistic observation, and content analysis.

PSYC 6207. Measurement in Organizations. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Presents an introduction to classical and modern test theory and methods. Topics include: Classical True Score Theory, reliability and validity inferences, and an introduction to factor analysis. Special emphasis is given to evaluating the quality of existing tests and assessments.

PSYC 6213. Physiological Foundations of Health Psychology. (3) Prerequisite(s): PSYC 6200. Biological theories and models will be introduced and applied to health issues. Topics may include addiction, mental illness, neuropsychology, and psychophysiology. Emphasizes the relation between the nervous system and behavior for understanding health and illness.

PSYC 6216. Introduction to Cognitive Science. (3) Cross-listed Course(s): ITCS 6216 and ITIS 6216. This course presents multiple perspectives on the study of intelligent systems. Broad coverage of such topics as philosophy of mind; human memory processes; reasoning and problem solving; artificial intelligence; language processing (human and machine); neural structures and processes; and vision. Also included is participation in the cognitive science seminar.

PSYC 6230. Applications of Social Psychology to Health Psychology. (3) Prerequisite(s): PSYC 6200. Social psychology theories and models will be introduced and applied to health issues. Topics may include the role of social perception processes in understanding and adjusting to illness, social influence strategies and promoting health-maintaining behaviors, self-efficacy and coping, and other factors related to health maintenance or recovery.

PSYC 6255. Community Interventions. (3) Cross-listed Course(s): HPSY 8255. Prerequisite(s): PSYC 6155 or HPSY 8155. Intensive review of the use of system- and organizational-level interventions to promote and maintain health, prevent illness, and improve quality of life. Presents an historical overview of the effectiveness of different types of interventions, and theoretical and empirical background regarding the conditions and factors that contribute to successful community interventions. Students develop and implement a community intervention, in collaboration with a local organization, and develop a grant proposal that would fund a community intervention.

PSYC 6260. Topics in Health Psychology. (3) Cross-listed Course(s): HPSY 8260. Prerequisite(s): PSYC 6200. An examination of selected topics in Health Psychology. *May be repeated for credit with permission of department.*

PSYC 6261. Independent Study in Health Psychology. (1 to 3) Prerequisite(s): PSYC 6200. Directed individual study of an issue in health psychology arranged with a faculty member. *May be repeated for credit.*

PSYC 6262. Practicum in Health Psychology. (1 to 3) Cross-listed Course(s): HPSY 8262. Prerequisite(s): PSYC 6200 and permission of the department. Experience in assessment and treatment with clients at local health agencies under supervision from a faculty member on campus. Applications of the principles of health psychology to special problems with in a healthcare organization or setting. *May be repeated for credit with permission of department.*

PSYC 6355. Community Research Practicum. (3) Cross-listed Course(s): PSYC 8355. Prerequisite(s): PSYC 6155 or HPSY 8155. Methods for conducting applied community

research. Students develop and implement applied research project.

PSYC 6450. Practicum in Clinical Psychology. (1 to 3) Cross-listed Course(s): HPSY 8450. Prerequisite(s): PSYC 6150 and permission of department. Experience in clinical assessment and/or psychotherapy with clients at local agencies under supervision from a faculty member on campus. *May be repeated for credit with permission of department.*

PSYC 6455. Practicum in Community Psychology. (1 to 3) Cross-listed Course(s): HPSY 8455. Applications of the principles of community psychology to special problems within an organization or community setting. The project might include, but would not be limited to, consultation, program development, training, community education or program evaluation. *May be repeated for credit with permission of department.*

PSYC 6477. Projects in Industrial/Organizational Psychology. (1 to 3) Prerequisite(s): PSYC 6171. A structured practicum experience or research paper in industrial/organizational psychology. *May be repeated for credit with permission of department.*

PSYC 6610. Micro Organizational Science I. (3) Cross-listed Course(s): OSCI 8610. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Examines research, theory and application regarding individual differences (e.g., abilities, personality), assessment (e.g., tests, inventories, interviews, assessment centers), criterion development (e.g., job analysis, performance models) and organizational staffing processes (i.e., recruitment, selection, basic legal concepts).

PSYC 6611. Macro Organizational Science I. (3) Cross-listed Course(s): OSCI 8611. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Examines research, theory and application on the following topics: motivation, communication systems and processes, stress, job design, leadership, employee attitudes and emotions, teamwork, and decision making.

PSYC 6617. Computational Human Behavior Modeling. (3) Cross-listed Course(s): ITCS 6617. Computational human behavior modeling is a research area at the intersection of computer science and social science, including psychology, sociology, communication, and linguistics. Its objective is to advance both fields by combining the power of data analytics and artificial intelligence with the scientific method for studying human data and human behavior. This course is a research seminar in which students engage with research through a series of readings, understanding concepts in the social sciences about human language, attitudes, and behaviors and understand how these concepts can be formalized into computational models or algorithms.

PSYC 6620. Micro Organizational Science II. (3) Cross-listed Course(s): OSCI 8620. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Examines research, theory and application regarding post-entry personnel issues such as training, performance management, performance appraisal, compensation, and employee socialization.

PSYC 6621. Macro Organizational Science II. (3) Cross-listed Course(s): OSCI 8621. Prerequisite(s): Full graduate standing in the I/O psychology graduate program or permission of instructor. Examines research, theory and application on the following topics: organizational development, organizational change, organizational climate, organizational culture, organizational theory, and relations between organizations and their environment.

PSYC 6630. Topics in Talent Management. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Examination of special topic(s) germane to talent management. The seminar may focus on one or a small number of topics salient to this area. *May be repeated for credit with change of topic.*

PSYC 6640. Topics in Organizational Psychology. (3) Prerequisite(s): Enrollment in M.A. in Industrial/Organizational Psychology program, and permission of department or instructor. Examination of special topic(s) germane to organizational psychology. The seminar may focus on one or a small number of topics salient this area. *May be repeated for credit with change of topic.*

PSYC 6650. Research Methods Seminar in Organizational Science. (3) Cross-listed Course(s): OSCI 8650. Prerequisite(s): Full graduate standing in a psychology graduate program or permission of instructor. Examination of special topic(s) germane to research methods in Organizational Science. The seminar may focus on one or a small number of topics that define this area (e.g., a data analytic technique, a methodological approach). Extensive reading and discussion of topics from multiple perspectives. *May be repeated for credit.*

PSYC 6899. Readings and Research in Psychology. (1 to 4) Cross-listed Course(s): HPSY 8899. Prerequisite(s): Permission of instructor and department to be obtained in the semester preceding the semester in which the course is to be taken. Individual study in psychology which may take the form of conducting empirical research or formulating a critique and synthesis of existing research. *May be repeated for credit.*

PSYC 6999. Thesis. (1 to 3) The thesis is coordinated with the student's interests and practical experience during the second year to allow the development of an area of specialization. Thesis projects can be of three types: an original experiment that will contribute to the psychological literature; a thorough case analysis including literature review and application; the development of a community psychology program or intervention to accomplish an important, well-defined goal. A completed paper and oral presentation are required. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit with permission of department.*

PSYC 8000. Interdisciplinary Approaches to Health. (3) Prerequisite(s): HPSY 8200 and doctoral student standing. Provides an overview of conceptualizations of health as approached from different disciplines, including psychology, medicine, nursing, and public health. Examines ways that the construct of health is used in research and treatment by various disciplines. Facilitation of understanding of interdisciplinary models of research addressing health issues is a primary goal of the course. In addition, it fosters the development of appreciation for contributions that various disciplines make to treatment of illness and promotion of health. It also emphasize the development of effective communication with multiple disciplines in research and treatment settings.

PSYC 8112. Applied Behavior Analysis. (3) Cross-listed Course(s): PSYC 6112. Use of behavior principles in applied settings. Topics include: behavioral assessment, positive and negative reinforcement, punishment, extinction, stimulus control, maintenance and generalization of behavior change. Each student will design and carry out a behavior change project.

PSYC 8203. Research Seminar. (1) Prerequisite(s): Admission to the Health Psychology Ph.D. Program. A seminar course introducing students to health psychology research in the university. Topics include: a discussion of specific ongoing health psychology research, IRB procedures, presenting data at professional conferences, and submission of journal articles and research grants. The course must be taken once in the fall and once in the spring of the student's first full year in the Ph.D. program in Health Psychology. *May be repeated for credit one time.*

PSYC 8222. Teaching of Psychology. (3) Prerequisite(s): Admission to the Ph.D. program in Health Psychology and permission of instructor. Strategies for, and issues related to, teaching undergraduate courses in psychology as part of a general undergraduate education.

PSYC 8355. Community Research Practicum. (3) Cross-listed Course(s): PSYC 6355. Prerequisite(s): HPSY 8155 and doctoral student standing. Methods for conducting applied community research. Students develop and implement applied research project.

PSYC 8422. Advanced Practicum in the Teaching of Psychology. (1 to 3) Prerequisite(s): PSYC 8222 and permission of graduate program director. The advanced training and supervision in the teaching of psychology course feature application of the principles of good teaching in psychology to address problems encountered in the classroom and to suggest opportunities for greater effectiveness. Readings from professional journals, discussion, and practical application in the classroom, including instructor observation, are used to meet course objectives. May be repeated for credit with department approval.

PSYC 8636. The Social Context of Mental Health. (3) Cross-listed Course(s): SOCY 6635, SOWK 6635, and PPOL 8636. Prerequisite(s): Admission to a graduate program or permission of instructor. Draws upon contributions from the field of psychiatry, psychology, social work, and anthropology. Focuses on mental health and illness it is social context, with an emphasis on the relationship between social structure and mental health/disorder. Examines the social factors which shape psychiatric diagnosis, the effects of socio-demographic variables on mental health, and the role of social support and stress for different groups. Also examines the organization, delivery, and evaluation of mental health services, and mental healthcare policy.

Reading, Language, and Literacy (READ)

READ 5000. Topics in Reading, Language, and Literacy. (1 to 6) May include classroom and/or clinical experiences in the content areas. *May be repeated for credit with change of topic and permission of department.*

READ 5111. Essentials of Literacy Instruction. (2) Prerequisite(s): Admission to Graduate Certificate in Elementary Education program. Corequisite(s): ELED 5110 and ELED 5112L. Research, theory, and instructional practice related to the reading process and reading instruction in the elementary school with a focus on the essential components of literacy: concepts about print, phonological awareness and phonemic awareness, phonics, fluency, vocabulary, comprehension, and writing. Emphasis is placed on instruction. Includes an extensive field-based component.

READ 5200. Early Literacy and Assessment. (3) Prerequisite(s): ELED 5101. Research, theory, and instructional practice related to the reading process and

reading instruction in the elementary school with a focus on emergent reading behaviors; phonics and phonemic awareness; balanced literacy; assessment-based instruction; and meeting the needs of diverse learners. Includes an extensive field-based component (approximately 20 hours).

READ 5211. Methods of Literacy. (2) Prerequisite(s): ELED 5110, ELED 5112L, and READ 5111. Corequisite(s): ELED 5210 and ELED 5212L. Research, theory, and instructional practice related to the reading process and reading instruction in the elementary school with a focus on essential literacy practices, explicit teaching, integrating the communication processes with all subject areas, comprehension, authentic assessment-based instruction, addressing the needs of diverse and struggling readers, and small group and whole class reading instructional practices. Includes an extensive field-based component.

READ 5255. Integrating Reading and Writing in the Content Areas. (3) Critical role of reading in learning course content in almost every subject area in the curriculum. Further, it is often the vehicle for assessing students across subjects. Methods for helping students become better readers. Extensive clinical experience required.

READ 5300. Applied Literacy Practices. (3) Prerequisite(s): READ 5200. Research, theory, and instructional practice related to integrating the communication processes with all subject areas with a focus on vocabulary, comprehension, study skills, addressing the needs of diverse and struggling readers, and instructional approaches in a reading classroom. Includes an extensive, field-based component (20 hours of clinical experiences are required).

READ 5311. Literacy Assessment and Tiered Interventions. (2) Prerequisite(s): ELED 5210, ELED 5212L, and READ 5211. Corequisite(s): ELED 5310 and ELED 5312L. Understand and use a variety of evidence-based reading assessments to diagnose areas of difficulty in reading or reading abilities/deficiencies; track and predict student progress; plan and implement appropriate instruction, supports, and interventions to meet the needs of all students; and determine the effectiveness of instructional practices. Includes an extensive field-based component.

READ 6000. Topics in Reading, Language, and Literacy. (1 to 6) Cross-listed Course(s): EDCI 8040. May include classroom and/or clinic experiences in the content areas. *May be repeated for credit with permission of department.*

READ 6100. Trends and Issues in Literacy and Leadership. (3) Cross-listed Course(s): EDCI 8140. Theories, research, and current issues associated with literacy, preschool through high school. Students explore current scholarship related to early literacy, adolescent literacy, reading instruction and assessment, family literacy, literacy coaching, and digital literacies, as well as other current literacy issues.

READ 6204. Teaching Reading to English Language Learners (3) Research, theory, and instructional practices related to the reading process and reading instruction for English Language Learners in K-12 classrooms; relationship between language development and reading; examination of instructional materials; and field-based application of course content.

READ 6250. Emergent and Elementary Literacy. (3) Cross-listed Course(s): EDCI 8250. Prerequisite(s): Completion of Phase I. Critical reading and use of the literature in literacy education, examination of literacy content taught in the K-6 curriculum with an emphasis on pre-K and beginning reading instruction research, theory and practice, multiple models and approaches for teaching and assessing learning in literacy development, required action research project.

READ 6252. K-12 Writing Development and Instruction. (3) Cross-listed Course(s): EDCI 8252. Theories, research, and critical issues related to students' writing development and effective writing instruction. Field experience required.

READ 6255. Middle/Secondary Reading and Writing. (3) Cross-listed Course(s): EDCI 8255. Prerequisite(s): Completion of Phase I. Theories, research, and instructional methods associated with reading and writing in the content areas, with a special emphasis on grades 6-12. Field experience and action research project are required.

READ 6260. Diagnostic Assessment and Instruction in Reading. (3) Cross-listed Course(s): EDCI 8256. Prerequisite(s): Completion of Phases I and II. Examination, uses, and critique of theories and research about literacy processes and problems; diagnosis and correction of reading disabilities; instructional strategies designed to improve reading proficiency.

READ 6265. Multiliteracies in a Global World: Reading and Writing Texts in New Times. (3) Cross-listed Course(s): EDCI 8265. Immerses students in both the theory and practice of multiliteracies and considers how globalization has created a more complex environment for teachers and students. Focus goes beyond traditional print-based literacy to multiple forms of knowing, including print, images, video, combinations of forms in digital contexts, which are represented in inter-related and complex ways.

READ 6300. Global Literacy in a Multicultural World: Genre Study. (3) Examines various genres and texts that

provide a global and multicultural perspective of literacy, and considers methods for incorporating these genres and texts into the K-12 classroom.

READ 6474. Collaborative Leadership in Literacy Education. (3) Cross-listed Course(s): EDCI 8254. Prerequisite(s): Completion of Phases I, II, and III; READ 6260. Investigates models and strategies for assuming the leadership responsibilities of a literacy specialist, including mentoring, staff development, school-wide literacy program development and assessment, supporting the action research of teachers, and developing partnerships with parents and community volunteers.

READ 6800. Individual Study in Reading, Language, and Literacy. (1 to 6) Cross-listed Course(s): EDCI 8840. Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

Religious Studies (RELS)

RELS 5000. Topics in Religious Studies. (3) Prerequisite(s): Permission of instructor. Major topics in religious studies. *May be repeated for credit.*

RELS 5010. Major Figure in Religious Studies. (3) The life and works of a major figure who has contributed to religious studies. *May be repeated for credit with change of figure.*

RELS 5101. Religion and Modern Thought. (3) The interaction of modern thought and modern religious sensibilities.

RELS 5107. Early Judaism. (3) Comparative historical and literary study of the varieties of Judaism evidenced during late antiquity (circa 70-640 C.E.), with special attention devoted to the formation and development of rabbinic Judaism.

RELS 5108. Medieval Judaism. (3) Comparative historical and literary study of the varieties of Judaism evidenced in Western Europe, the Byzantine Empire, and Islamicate realms from approximately 640 C.E. to approximately 1492 C.E.

RELS 5109. Modern Judaism. (3) Historical and conceptual study of Judaism and Jewish experience in Europe, America, and Israel, from the 16th century to the present, with special attention paid to the development of denominations, Zionism, and the Holocaust.

RELS 5110. Contemporary Jewish Thought. (3) An examination of philosophy, religion, morality, politics, sociality, culture, family, and self-identity, in the light of modern and recent Jewish thought.

RELS 5201. Religion, Morality, and Justice. (3) Explores the ethical and social dimensions of selected religious traditions in their cultural contexts.

RELS 5301. The Other Cheek: From Christian Disdain to the Organized Destruction of Europe Jews. (3) Cross-listed Course(s): RELS 4101. Jews as deicides, ritual murderers, agents of Satan, international conspirators, conniving Shylocks, financial manipulators, sub-human - is the western world's collective mythology about Jews a deeply rooted cultural pathology? How does one distinguish prejudice, Jew-hatred, and anti-Semitism, and on what theoretical basis? Did anti-Semitism pre-date the emergence of Christianity? This course addresses these questions and more. In the process, students assess - and perhaps co-create - theories about the nature of European anti-Semitism.

RELS 6000. Topics in Religious Studies. (3) Prerequisite(s): Permission of instructor. Major topics in religious studies. *May be repeated for credit.*

RELS 6101. Approaches to the Study of Religion. (3) Prerequisite(s): Permission of department. Provides students with critical tools for research, analytical thinking, and writing in the academic study of religion. The topics and individuals this course covers represent several major currents of thought in the field of religious studies.

RELS 6102. Teaching in the Humanities. (3) Prerequisite(s): Permission of department. Approaches the academic study of religion through the lens of its particular pedagogical challenges and rewards. Explores the history of religious studies in American classrooms, and surveys the scholarship of teaching and learning. Examination of a range of pedagogical philosophies where students may articulate their own vision of teaching. Students also have an opportunity to develop teaching portfolios, syllabi, and to create meaningful assignments.

RELS 6103. Material Christianity. (3) Prerequisite(s): Permission of department. Explores the ways in which individuals and societies throughout the Christian tradition have invested material objects with sanctity and power.

RELS 6104. Religion and Art in Islam. (3) Prerequisite(s): Permission of department. Explores the relationships between Islamic thought and the development of Islamic art and architecture.

RELS 6105. Religion, Art, and Architecture of East Asia. (3) Prerequisite(s): Permission of department. A study of the religious ideas in physical forms in the cultures of China

and Japan. The course focuses on the Confucian, Daoist, and Buddhist traditions.

RELS 6111. Qumran and its Literature. (3) Prerequisite(s): Permission of department. A study of the manuscripts recovered from the caves of Qumran. Attention given to their connections to Second Temple Judaism, early Christianity, and later developments in Islam.

RELS 6602. Seminar in the Religion of Ancient Israel. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the study of the religion of ancient Israel. A general theme must be chosen which at times will be keyed to the pertinent archaeological evidence available for evaluating the complex scope of Israelite religiosity, but which at other times may selectively focus on narratological descriptions of religious behavior (e.g., the religious ideology of Deuteronomy). Extensive attention is devoted to the comparative study of Israelite religion within its ancient Near Eastern context. *May be repeated with change of topic.*

RELS 6603. Seminar in Early Judaism. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the historical-critical study of early Judaism and its literature. A general theme must be chosen: a narrative source (Mishnah, Midrash, Talmud); a subdivision of texts (Jewish apocrypha and pseudepigrapha) or literary genres (apocalyptic literature); a single ancient text (1 Enoch; Avot de R. Natan); or a topical investigation (written and oral Torah; construction of authority in rabbinic Judaism; sectarian disputes within early Judaism; cultural impact of the Roman destruction of the Temple). *May be repeated with change of topic.*

RELS 6612. Seminar in Christian Origins. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the historical-critical study of the origins and development of earliest Christianity. A general theme must be chosen; an historical figure (John the Baptist, Jesus, Paul, James); an ancient text (a New Testament document; Gospel of Thomas; the Gnostic Nag Hammadi codices); or a topical investigation (Jesus and the Dead Sea Scrolls; the development of early Christian liturgy; the development of early Christian Christology; ancient Judaism and emerging Christianity). *May be repeated with change of topic.*

RELS 6615. Seminar in the Religions of Late Antiquity. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the academic study of one or more of the religions practiced in the Roman and/or Sasanian Empires during late antiquity. A general theme must be chosen that may center upon one or more specific religious identities or trajectories; one or more textual traditions; an influential figure or interpretive school; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6622. Seminar in Religion and Modern Culture. (3) Prerequisite(s): Permission of department. A seminar on issues related to the historical-critical study of the interaction between religion and modern culture. One or more general themes will be chosen: leading theorists, appropriate historical contexts, global contexts, or a topical investigation. *May be repeated with change of topic.*

RELS 6625. Seminar in American Religions. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the academic study of one or more of the religions of North America. A general theme must be chosen that may center upon one or more specific religious traditions; an important individual figure or character; an historical period or epoch; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6631. Seminar in Islamic Studies. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the academic study of Islam. A general theme must be chosen that may center upon one or more schools of thought; an important individual figure or character; one or more textual sources or literary genres; an historical period or epoch; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6641. Seminar in Asian Religions. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the academic study of one or more of the religions of South and/or East Asia. A general theme must be chosen that may center upon one or more specific religious traditions; an important individual figure or character; one or more textual sources or literary genres; an historical period or epoch; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6651. Seminar in the History of Religions. (3) Prerequisite(s): Permission of department. Current and seminal issues related to the academic study of one or more of the interpretive categories or concepts associated with the practice and expression of religion(s). A general theme must be chosen that may center upon a specific interpretive category or concept; an influential scholar or school of interpretation; a prominent historical period or cultural movement; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6671. Seminar in Theory and Methods. (3) Prerequisite(s): Permission of department. Current and seminal issues related to contemporary theory and cultural studies and their import for the academic study of religion(s). A general theme must be chosen that may center one or more specific theories or methods; an influential thinker or school of thought; an historical period

or cultural movement; or a topical investigation. *May be repeated for credit with change of topic.*

RELS 6800. Directed Readings/Research. (1 to 3) Prerequisite(s): Prior written permission of instructor. Investigation of a topic in religious studies culminating in a research paper. *May be repeated for credit with change of topic.*

RELS 6999. Thesis. (3 or 6) The thesis is coordinated with the student's interests and practical experience to allow the development of an area of specialization. Appropriate research and written exposition of that research is required. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit with permission of department, if taken for 3 credit hours. Six credit hours of Thesis may be taken during a single semester.*

Respiratory Care (RESP)

RESP 5101. Health Outcomes and Quality Assessment. (3) Cross-listed Course(s):: RESP 4101. Prerequisite(s): RESP 6101 or permission of instructor. An overview of the U.S. healthcare system and healthcare organizational structure. Emphasis placed on developing knowledge and skills using evidence-based methods and techniques to design, implement, and evaluate healthcare quality control/improvement and patient safety initiatives.

RESP 5102. Department Management in the Healthcare Environment. (3) Cross-listed Course(s):: RESP 4102. Prerequisite(s): RESP 5101 and RESP 6101. Provides an understanding of the administrative and financial aspects of healthcare management, introducing concepts related to strategic planning and healthcare marketing. Students learn about financing healthcare and health insurance, as well as managing costs and revenues associated with department management. Human resources, legal, and policy concepts related to outpatient, inpatient, public, and private sectors are examined.

RESP 6101. Respiratory Care Leadership. (3) Provides an in-depth knowledge of foundations, scholarship, and practice of leadership. Introduces concepts related to leading people and managing resources into the future. Focuses on using an evidence-based approach to making decisions in a complex healthcare environment.

RESP 6102. Pulmonary Disease Management. (3) Corequisite(s): RESP 6101. A case-based exploration of pulmonary disease management that presents the pathophysiology, diagnosis, and management of common respiratory diseases that Respiratory Therapists encounter in clinical practice. Didactic content is presented online, and students lead synchronous discussion of cases online and manage related discussion forums on topics related to specific disease entities. The course is organized into 4 modules that address respiratory insufficiency, airway diseases, inflammatory lung disease, and a final module on neuromuscular disease, lung cancer, and postoperative pulmonary complications.

RESP 6103. Cardiovascular Disease Management. (3) A case-based exploration of cardiovascular disease management that presents the pathophysiology, diagnosis, and management of common cardiovascular diseases that Respiratory Therapists encounter in clinical practice. Didactic content is presented online, and students lead synchronous discussion of cases online and manage related discussion forums on topics related to specific disease entities. The course is organized into 4 modules that address cardiac insufficiency, structural diseases, vascular disease, and a final module on sleep-disordered breathing, trauma, dysrhythmias, and end-of-life care.

RESP 6104. Health Policy, Law, and Ethics in the Health Professions. (3) An overview of health policy, law, and ethics in relation to allied health professionals and in the broader health care context. Explores essential issues related to development of health policy and law.

RESP 6105. Pulmonary Function Testing and Cardiopulmonary Rehabilitation. (3) An introduction to open and closed systems of pulmonary function testing, including the theory and operations of the body plethysmograph. The management and quality control of the pulmonary function lab is discussed. Also included are selected theories and practices in pulmonary rehabilitation and the planning of the components of an effective comprehensive multi-disciplinary pulmonary rehabilitation program. Topics and emphasis may vary.

RESP 6106. Ventilation Application and Monitoring. (3) Provides in-depth knowledge of advanced theory, set-up, operation, and maintenance of mechanical ventilators and related equipment, as well as instruction on all phases of continuous mechanical ventilation. The history of mechanical ventilation, modes of mechanical ventilator support, implementation, monitoring, ventilator weaning and discontinuation are covered. Cutting-edge ventilator modes, noninvasive ventilators and high frequency oscillators are discussed. The integration of advanced techniques for invasive and noninvasive patient monitoring is also reviewed. Topics and emphasis may vary.

RESP 6110. Cardiopulmonary Disease Management. (3) A case-based exploration of disease management that presents the pathophysiology, diagnosis, treatment, and management of cardiopulmonary diseases commonly encountered in clinical practice. Emphasis is placed on

using an evidence-based practice approach. Cardiopulmonary disease topics and emphasis may vary.

RESP 6115. Research Methods for Respiratory Care. (3) Methods of inquiry for research are explored and critiqued within the field of respiratory care, with an emphasis on developing skills useful for conducting and evaluating basic, applied, and clinical research. Students review a selection of appropriate basic statistics and analysis of data.

RESP 6601. Emerging Issues in Respiratory Care Seminar. (3) Explores emerging issues of interest related to respiratory care and healthcare in the broader context. Topics and emphasis may vary.

RESP 6801. Advanced Credential Exam Preparation Course. (3) Prerequisite(s): RESP 6101, RESP 6102, RESP 6103, and RESP 6105. Prepares M.S. in Respiratory Care students for an National Board of Respiratory Care (NBRC) specialty exam of interest. These may include, but are not limited to, the ACCS, NPS, or RPFT credentialing exam. Topics and emphasis may vary. Credit by exam is given to students who have already successfully completed all advanced credentialing exams offered by the NBRC.

RESP 6802. Respiratory Care Capstone. (7) Prerequisite(s): RESP 6101, RESP 6102, RESP 6103, and RESP 6601. Students develop a project in their clinical, community, or educational environment that impacts positive change, with the focus on quality improvement, management, education, research, or advanced clinical practice at the discretion of the student under faculty guidance. Elements include interviews, data management, and literature review that culminate in a systematic review, poster, oral presentation, and a comprehensive paper documenting the project.

RESP 6803. Respiratory Care Capstone I. (3) Prerequisite(s): RESP 6101, RESP 6106, and RESP 6115. Students develop a project in their clinical environment, community, or educational environment that impacts positive change. The focus is on quality improvement, management, education, research, or advanced clinical practice at the discretion of the student under faculty guidance. Emphasis is placed on the development, refinement, and presentation of the capstone project proposal.

RESP 6804. Respiratory Care Capstone II. (3) Prerequisite(s): RESP 6803. Students complete a project in their clinical, community, or educational environment that impacts positive change. The focus is on quality improvement, management, education, research, or advanced clinical practice at the discretion of the student under faculty guidance. Emphasis is placed on data collection, data analysis and interpretation, and presentation of the capstone project findings and implications.

Educational Research, Measurement, and Evaluation (RSCH)

RSCH 6101. Research Methods. (3) An orientation to designs and procedures utilized in educational research, emphasizing basic principles for conducting research, interpreting and evaluating published articles representative of educational problems and issues.

RSCH 6109. Assessment and Evaluation Methods. (3) Prerequisite(s): RSCH 6101 or equivalent. Fundamentals of individual and group assessment, including selection, administration, and interpretation of norm-referenced and criterion-referenced assessment instruments and demonstration of competencies prescribed by the State of North Carolina and other professional organizational standards.

RSCH 6110. Descriptive and Inferential Statistics. (3) Prerequisite(s): RSCH 6101 or equivalent. Identification of objective reporting and decision-making statistics; application of descriptive and inferential methods; illustration of elementary parametric and non-parametric techniques in hypothesis testing; and, demonstration of the fundamentals of data processing.

RSCH 6120. Advanced Statistics. (3) Prerequisite(s): RSCH 6101 and RSCH 6110 or equivalent. Application of advanced topics in probability and statistics as a basis for objective decision-making, with emphasis on the following practices through analysis of prepared data: multiple correlation and regression, one-way and n-way analysis of variance and covariance, advanced ANOVA designs, advanced non-parametric methods, and, selected multivariate statistical procedures.

RSCH 6130. Presentation and Computer Analysis of Data. (3) Fundamentals of data presentation and analysis using computer-based statistical packages (e.g., SPSS, SYSTAT, BMDP, SAS); application of basic descriptive statistics, correlational and associational measures, and inferential statistics emphasized in a series of analyses of prepared data; description of data sets and preparation of graphic presentations.

RSCH 6800. Independent Study in Research. (3) Faculty-directed independent study of topics not provided by other research course offerings and/or to examine, extend, and enrich extant research knowledge through supervised individual study.

RSCH 6890. Special Topics in Research. (3) Faculty-directed study and in-depth analysis of a selected area of research.

RSCH 7111. Qualitative Research Methods. (3) Cross-listed Course(s): RSCH 8111. Demonstration of historical, philosophical, biographical, ethnographic, and case study methods; location of information sources, application of methods of data collection and analysis, field techniques, and strategies for writing research results.

RSCH 7112. Survey Research Methods. (3) Cross-listed Course(s): RSCH 8112. Prerequisite(s): RSCH 6101 or equivalent. Techniques of survey research, including developing proposals, addressing ethical issues, selecting direct and indirect methods, preparing questionnaires, sampling, analyzing and presenting data, writing research reports, extending applications to program evaluation.

RSCH 7113. Single-Case Research. (3) In-depth study of single-case research methods, including data collection, research designs, data display and analysis, and report writing.

RSCH 7121. Qualitative Data Collection and Analysis. (3) Prerequisite(s): RSCH 7111 or permission of instructor. An advanced qualitative research methods course introducing various qualitative data collection and analysis techniques. Multiple analytic strategies are surveyed and compared from a range of social sciences. Also provides a practical introduction to the use of computer packages for qualitative data analysis.

RSCH 7140. Multivariate Statistics. (3) Cross-listed Course(s): RSCH 8140. Prerequisite(s): RSCH 6101, RSCH 6110, and RSCH 6120, or equivalent. Multiple regression, multivariate analysis of variance, discriminant function analysis, factor analysis, and other multivariate methods applied to descriptive, correlational, and experimental research problems.

RSCH 7150. Structural Equation Modeling. (3) Cross-listed Course(s): RSCH 8150. Prerequisite(s): RSCH 6110 and RSCH 6120, or equivalent. Applies general statistical modeling techniques to establish relationships among variables. Topics include: regression models, path analysis models, exploratory and confirmatory factor analyses, latent variables, basic steps in structural equation modeling, multiple indicators and multiple causes (MIMIC) model, multi-group model, multilevel model, mixture model, structured mean model, second order factor model, latent variable growth model, and dynamic factor model.

RSCH 7160. Hierarchical Linear Models in Education. (3) Cross-listed Course(s): RSCH 8160. Prerequisite(s): RSCH 6110 and RSCH 6120. An applied course in hierarchical linear models. Emphases are placed on practical issues, such as selecting appropriate statistical analyses to investigate research questions, using SPSS, HLM, and SAS to analyze data, interpret results, and applying the analyses in research areas of interest.

RSCH 7196. Program Evaluation Methods. (3) Cross-listed Course(s): RSCH 8196. Examination of principles, strategies, and techniques of program evaluation in order to identify, clarify, and apply defensible criteria that indicate a program's value, quality, utility, effectiveness, and/or significance.

RSCH 7197. Design and Analysis of Experimental and Quasi-Experimental Evaluations. (3) Cross-listed Course(s): RSCH 8197. Prerequisite(s): RSCH 6101 and RSCH 6110 or equivalents. Critical examination of the theoretical, ethical, and practical strategies involving the design and analysis of experiments and quasi-experiments to promote causal inference in evaluation studies and lead to defensible claims of effectiveness, practical significance, and value.

RSCH 8110. Descriptive and Inferential Statistics. (3) Prerequisite(s): RSCH 8210 or equivalent. Identification of objective reporting and decision-making statistics; application of descriptive and inferential methods; illustration of elementary parametric and non-parametric techniques in hypothesis testing; and, demonstration of the fundamentals of data processing.

RSCH 8111. Qualitative Research Methods. (3) Cross-listed Course(s): RSCH 7111. Demonstration of historical, philosophical, biographical, ethnographic, and case study methods; location of information sources, application of methods of data collection and analysis, field techniques, and strategies for writing research results.

RSCH 8112. Survey Research Methods. (3) Cross-listed Course(s): RSCH 7112. Prerequisite(s): RSCH 8210 or equivalent. Techniques of survey research, including developing proposals, addressing ethical issues, selecting direct and indirect methods, preparing questionnaires, sampling, analyzing and presenting data, writing research reports, extending applications to program evaluation.

RSCH 8113. Single-Case Research. (3) In-depth study of single-case research methods (i.e., data collection, research designs, data display and analysis, and proposal writing), using single-case research to establish evidence-based practices, and effect size metrics for single-case research.

RSCH 8120. Advanced Statistics. (3) Prerequisite(s): RSCH 8210 and 8110 or equivalent. Application of advanced topics in probability and statistics as a basis for objective decision-making, with emphasis on the following practices through analysis of prepared data: multiple correlation and regression, one-way and n-way analysis of variance and

covariance, advanced ANOVA designs, advanced non-parametric methods, and, selected multivariate statistical procedures.

RSCH 8121. Qualitative Data Collection and Analysis. (3) Prerequisite(s): RSCH 8111 or permission of instructor. An advanced qualitative research methods course introducing various qualitative data collection and analysis techniques. Multiple analytic strategies are surveyed and compared from a range of social sciences. Also provides a practical introduction to the use of computer packages for qualitative data analysis.

RSCH 8130. Presentation and Computer Analysis of Data. (3) Fundamentals of data presentation and analysis using computer-based statistical packages (e.g., SPSS, SYSTAT, BMDP, SAS); application of basic descriptive statistics, correlational and associational measures, and inferential statistics emphasized in a series of analyses of prepared data; description of data sets and preparation of graphic presentations.

RSCH 8140. Multivariate Statistics. (3) Cross-listed Course(s): RSCH 7140. Prerequisite(s): RSCH 8210, RSCH 8110, and RSCH 8120 or equivalent. Multiple regression, multivariate analysis of variance, discriminant function analysis, factor analysis, and other multivariate methods applied to descriptive, correlational, and experimental research problems.

RSCH 8150. Structural Equation Modeling. (3) Cross-listed Course(s): RSCH 7150. Prerequisite(s): RSCH 8110 and RSCH 8120, or equivalent. Applies general statistical modeling techniques to establish relationships among variables. Topics include: regression models, path analysis models, exploratory and confirmatory factor analyses, latent variables, basic steps in structural equation modeling, multiple indicators and multiple causes (MIMIC) model, multi-group model, multilevel model, mixture model, structured mean model, second order factor model, latent variable growth model, and dynamic factor model.

RSCH 8160. Hierarchical Linear Models in Education. (3) Cross-listed Course(s): RSCH 6160. Prerequisite(s): RSCH 8110 and RSCH 8120. An applied course in hierarchical linear models. Emphases are placed on practical issues, such as selecting appropriate statistical analyses to investigate research questions, using SPSS, HLM, and SAS to analyze data, interpret results, and applying the analyses in research areas of interest.

RSCH 8196. Program Evaluation Methods. (3) Cross-listed Course(s): RSCH 7196. Examination of principles, strategies, and techniques of program evaluation in order to identify, clarify, and apply defensible criteria that indicate a program's value, quality, utility, effectiveness, and/or significance.

RSCH 8197. Design and Analysis of Experimental and Quasi-Experimental Evaluations. (3) Cross-listed Course(s): RSCH 7197. Prerequisite(s): RSCH 8110 and RSCH 8210 or equivalents. Critical examination of the theoretical, ethical, and practical strategies involving the design and analysis of experiments and quasi-experiments to promote causal inference in evaluation studies and lead to defensible claims of effectiveness, practical significance, and value.

RSCH 8210. Applied Research Methods. (3) Advanced study of qualitative (e.g., Case Study, Ethnography, Grounded Theory) and quantitative (e.g., Experimental, Single Subject, Descriptive, Correlational, Causal-Comparative) research methods and evaluation research approaches.

RSCH 8220. Educational and Psychological Measurement. (3) Prerequisite(s): RSCH 8110 or equivalent. Focuses on the basic principles of educational and psychological measurement. Concepts needed to evaluate and interpret results from standardized measures are emphasized. The course is devoted to developing fundamental measurement concepts and an understanding of common issues such as standard settings, differential item functioning, computerized adaptive testing, and scale linking and equating.

RSCH 8230. Theory and Applications of Measurement. (3) Prerequisite(s): RSCH 8110 or equivalent. Primary focus on methods of constructing instruments used in educational and psychological contexts for evaluation purposes, particularly instruments designed to measure student achievement and psychological constructs. Various stages of instrument development are considered with a focus on optimizing validity and reliability of scores. In addition, some fundamental psychometric theories including classical test theory, item response theory, and/or generalizability theory are also covered.

RSCH 8410. Internship in Educational Research. (3) Prerequisite(s): RSCH 8140 or equivalent. Issues and concepts in statistical consulting, educational research design, and educational measurement are applied to practical problems in the field. This course supports the professional development of doctoral students as they gain experience applying educational research methods to research projects for school systems and related agencies. *Graded on a Pass/Unsatisfactory basis.*

RSCH 8411. Internship in Teaching Educational Research. (3) Prerequisite(s): RSCH 8210. Issues and concepts in teaching adults and preparing educational researchers are applied in the college teaching experience. This course supports doctoral students as they experience a graduated co-teaching process ultimately resulting in assumption of full college teaching responsibilities for university courses in

educational research topics. *Graded on a Pass/Unsatisfactory basis.*

RSCH 8699. Dissertation Proposal Design. (3) Identification and definition of a research area and development of a proposal draft for an original research study appropriate for the dissertation requirement. *Graded on a Pass/Unsatisfactory basis.*

RSCH 8800. Independent Study in Research. (3) Faculty-directed independent study of topics not provided by other research course offerings and/or to examine, extend, and enrich extant research knowledge through supervised individual study.

RSCH 8890. Special Topics in Research. (3) Faculty-directed study and in-depth analysis of a selected area of research.

RSCH 8999. Dissertation. (1 to 6) Under the direction of a dissertation advisor and committee, students are expected to design and execute an original research study. This study should address a significant issue or program related to educational research. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term. May be repeated for credit up to 6 credit hours.*

Secondary Education (SECD)

SECD 5140. The Secondary School Experience. (2) Overview of the developmental characteristics of the adolescent learner and their relationship to instruction. Context of American High Schools and the effects of those schools on the learning of contemporary adolescents. Reform efforts currently underway in American high schools that attempt to address some of the problems with current practice. Extensive clinical experience is required.

SECD 6800. Individual Study in Secondary Education. (1 to 6) Prerequisite(s): Permission of the student's advisor.

Sociology (SOCY)

SOCY 5090. Topics in Sociology. (3) Prerequisite(s): Permission of instructor. Intensive treatment or survey of related topics, depending on student needs and interests. *May be repeated for credit with change of topic.*

SOCY 5111. Social Inequality. (3) Distribution of power, privilege and prestige; correlates and consequences of inequality; national and international comparisons.

SOCY 5125. Urban Sociology. (3) Cross cultural analysis of urban development, social structure, ecology, demographic composition, and social problems.

SOCY 5130. Sociology of Health and Illness. (3) The cultural and structural influences on the definition of health and illness; models of illness behaviors; health demography and epidemiology; social influences on the delivery of healthcare; ethical issues surrounding health and illness; the development of relevant social policy.

SOCY 5131. Family Policy. (3) Critical analysis of four aspects of family policy; the historical and cultural factors that have resulted in specific policies affecting the family; the specification of contemporary family policy at both the national and state level; the intended and actual application of existing family policy; and the implications and impact of policies as they are interpreted and implemented.

SOCY 5135. Sociology of Education. (3) Educational institution; the school class as a social system; the school as a social environment and a complex organization.

SOCY 5150. Older Individual and Society. (3) Cross-listed Course(s): GRNT 4150, GRNT 5150, and SOCY 5150. Study of the social and cultural context on the lives of aging individuals in American society. Includes a focus on expectations, social interactions, and psychological well-being in the context of retirement, caregiving, and health.

SOCY 5151. Pro-Seminar: Social Problems and Social Policy. (3) Prerequisite(s): graduate student in sociology or senior sociology major. Introduction to the discipline of sociology and the UNC Charlotte department; basic skills for graduate school. *Graded on a Pass/Unsatisfactory basis.*

SOCY 5154. Contemporary Social Theory. (3) Elements and process of theory construction; contemporary social theories such as theories of social order and causation, power, class structure and inequality; group process theories; post-modern theories.

SOCY 5156. Quantitative Analysis. (4) Prerequisite(s): SOCY 4155 or permission of instructor. Concepts and procedures of sociological analysis; data processing; measurement theory; and quantitative models of analysis. Three hours of lecture/discussion and completion of weekly laboratory units.

SOCY 5156L. Quantitative Analysis Laboratory. (0) Corequisite(s): SOCY 5156. Required weekly laboratory session for Quantitative Analysis.

SOCY 5290. The Experience of Loneliness. (3) Cross-listed Course(s): GRNT 4290, GRNT 5290, and SOCY 4290.

Explores the experience of loneliness among older adults in society. Drawing on academic texts, empirical research and personal accounts of loneliness, the aim is to identify the extent of loneliness experienced by older adults in various contexts. In particular, the readings consider the consequences of loneliness on the physical, mental, and social well-being of older adults.

SOCY 5631. Seminar in Family Violence. (3) Prerequisite(s): Senior or graduate standing, or permission of instructor. Family violence in the context of a changing society and family system. Principal foci: child abuse, sexual abuse, spouse abuse; other forms of family violence. Investigation of these topics in terms of sociocultural influences and internal dynamics of families.

SOCY 5632. Changing American Family. (3) Family theories; family system in relation to other social systems; integration of marital, parental and occupational roles in context of changing socioeconomic influences; traditional versus contemporary family roles; breakdown in stable family functioning.

SOCY 6090. Topics in Sociology. (3) Prerequisite(s): Permission of department. Intensive treatment of a topic or survey of related topics, depending on student needs and interests. *May be repeated for credit with change of topic.*

SOCY 6112. The Sociology of Work. (3) Theoretical and methodological approaches to work; work in a globalized society; work structures; inequalities at work; success at work; gender, race, ethnicity and age differences in the workplace; work-family balance; workplace transformation; historical studies of work; labor markets, employment and unemployment; work rewards; workplace and employment policies.

SOCY 6130. Sociology of Aging: Theories and Research. (3) Cross-listed Course(s): GRNT 6130. Application of stratification theories and demography are applied to the older population. Issues of race, gender, socio-economic status, age, and geographic distribution are examined to investigate the diversity of the older age group and their access to resources.

SOCY 6134. Family Caregiving Across the Lifespan: Theory, Practice, and Policy. (3) Cross-listed Course(s): GRNT 6134 and SOWK 6134. Theories explaining the formation and functioning of American families with an emphasis on the impact of the aging of society. Examines the current demographic trends and expectations of multigenerational families, with a focus on family caregiving. Addresses family care across the lifespan as a lifelong developmental construct, and examines evidence-based approaches to practice, education, research, and policy. Students examine a broad spectrum of care situations (from developmental disability to chronic illness, dementia care, and end of life) that necessitate family caregiving throughout the lifespan and discuss responses to these challenges by both caregiving families and caregiving systems.

SOCY 6135. Social Context of Schooling. (3) The political economy of schooling; race, class, and gender effects on educational processes and outcomes; the school as a complex organization; the sociology of school reform movements.

SOCY 6136. Qualitative Research Methods. (3) Collection and analysis of qualitative data including use of grounded theory and a variety of qualitative techniques, consideration of ethical issues and the use of data.

SOCY 6137. The Political Economy and School Reform. (3) Prerequisite(s): SOCY 4135, graduate standing, or permission of instructor. Relationship between the business community's vision for school reform and the school restructuring movement locally and nationally, including social and political processes associated with corporate involvement in defining the problem with schools and shaping solutions, the intersection of education and the economy, and the relationship between schooling and social inequality.

SOCY 6138. Social Organization of Healthcare. (3) Focuses on the structures and operations of healthcare institutions and providers. The topics covered include the socio-historical development of the existing healthcare system, healthcare occupations and professions, professional power and autonomy, professional socialization, inter-professional and provider-patient relations, healthcare organizations and the delivery of services, and how social change affects the healthcare sector.

SOCY 6614. Self and Society. (3) Examination of theoretical constructs and substantive concerns relevant to the socialization process; comparison of symbolic interactionism, ethnomethodology, phenomenology; emphasis on social construction of reality in various "social worlds" (deviant, work, family).

SOCY 6615. Dilemmas in Organizations. (3) Examines organizational theory and research focused on organizational behavior, inter-organizational relations, relations with external stakeholders and organizational culture. Case study analysis, group-problem solving and the study of concrete organizational dilemmas.

SOCY 6616. Stratification and Inequality. (3) Examination of theories of stratification and the causes, processes and social consequences of economic and political inequality; assumptions behind, mechanisms for, and consequences

of government and private sector strategies to address problems associated with inequality.

SOCY 6617. Data Utilization. (3) Methodological and statistical strategies for applied sociological research within organizational settings; selecting the best strategies consistent with budgetary, manpower and organizational constraints; interpreting and communicating research results in ways understandable to and useful for organizational decision-makers.

SOCY 6630. Investigating Health and Health Services. (3) Prerequisite(s): SOCY 4130, or graduate standing, or permission of instructor. Useful to those seeking research careers, to administrators in healthcare, and to primary care providers. How to conduct and evaluate research in healthcare settings, emphasizing both quantitative and qualitative methodologies as well as the utilization of secondary data.

SOCY 6635. The Social Context of Mental Health. (3) Cross-listed Course(s): SOWK 6635, PSYC 8636, and PPOL 8636. Prerequisite(s): Admission to graduate program or permission of instructor. This course draws upon contributions from the field of psychiatry, psychology, social work, and anthropology. The focus is on mental health and illness it is social context, with an emphasis on the relationship between social structure and mental health/disorder. We will examine the social factors which shape psychiatric diagnosis, the effects of socio-demographic variables on mental health, and the role of social support and stress for different groups. The course also examines the organization, delivery, and evaluation of mental health services, and mental healthcare policy.

SOCY 6640. Evaluation Research for Applied Sociology. (3) Prerequisite(s): SOCY 6652 and introductory statistics. Evaluation research from an applied sociological perspective, including incorporation of social theory, substantive social science knowledge, and research techniques into the evaluation of a variety of programs, interventions, and policies.

SOCY 6651. Social Theory. (3) Analysis of contemporary social theories, with emphasis on their implications for planned change.

SOCY 6652. Issues in Social Research. (3) Examination of epistemology of social research; assumptions and methods of specific research strategies; ethical and policy issues of applied and academic research.

SOCY 6895. Tutorial in Sociology. (1 to 4) Prerequisite(s): Permission of instructor. Directed reading and/or research; development of expertise in substantive area. *May be repeated for credit.*

SOCY 6897. Research Practicum. (1 to 6) Prerequisite(s): SOCY 6651 and 6652. Preparation of research paper based upon research completed within a community organization or agency. The student will develop a consultant-client relationship with the agency or organization and conduct a research/evaluation project on behalf of the agency or organization (such as a needs assessment, program evaluation, social impact assessment or policy analysis.

SOCY 6996. Thesis. (1 to 6) Prerequisite(s): completion of all other coursework and admission to candidacy by Graduate Committee. Applied, academic, or theoretical research project, defended before graduate faculty. *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 6 credit hours.*

Social Work (SOWK)

SOWK 5090. Topics in Social Work. (1 to 3) Cross-listed Course(s): SOWK 4090. Specialized topics in social work. *May be repeated for credit two times.*

SOWK 5101. Social Work Practice with Older Adults and Families. (3) Cross-listed Course(s): SOWK 4101 and GRNT 5050. Provides an opportunity to integrate the theories and practice skills needed for effective social work and services to with older adults and their families.

SOWK 5102. School Social Work. (3) Exploration of school social work practices from a theoretical as well as practical point of view. Also focuses on the roles of school social workers and the type of issues they confront.

SOWK 5103. Child Welfare. (3) Prerequisite(s): Permission of MSW Program Director or instructor. Examination of the history, purpose, and goals of child welfare services in North Carolina and in the United States. Course information is provided from the context of the child- and family-centered model that guides child welfare services.

SOWK 5104. Interprofessional Collaboration in Healthcare. (3) Cross-listed Course(s): NURS 6282. Prerequisite(s): Enrollment in IBHS program. Provides interprofessional education opportunities to prepare health professionals for team-based care of patients, families, and communities. Focuses on the use of ethical care, effective communication, and teamwork and collaborative practice to improve health outcomes. Emphasis on frameworks for understanding health and principles of patient and family-centered care to improve physical, mental, and social well-being.

SOWK 5109. Systems of Care for Vulnerable Populations. (3) Cross-listed Course(s): SOWK 4109. Focuses on engaging diversity and difference in practice in relation to social work skills with individuals, families, and groups.

SOWK 5110. Social Work Practice with Immigrants and Refugees. (3) Cross-listed Course(s): SOWK 4110. Students develop the skills, knowledge, values, and critical thinking capacity to practice social work with immigrants and refugees. Students: 1) describe historical and theoretical perspectives of migration, 2) analyze the intersection of migration with core areas of social work practice, including child welfare, criminal justice, education, mental health, and health systems, and 3) develop culturally responsive advocacy efforts and intervention strategies to improve immigrant and refugee well-being.

SOWK 5111. Promoting Healing Through Mindfulness and Resiliency. (3) Integrates the theories and practice skills needed for effective social work with older adults with major physical and mental health concerns and the older adults' families.

SOWK 5112. Forensic Social Work. (3) Forensic social work is the application of social work to questions and issues relating to judicial and legal systems. This specialty of the social work profession includes, but is not limited to: child custody issues, implications of child abuse and domestic violence, juvenile and adult justice services, corrections, competency and commitment, civil liberties and rights, mass incarceration, and probation and parole.

SOWK 5113. Mental Health and Substance Use. (3) Increases awareness of mental health and substance abuse issues with both macro and micro practices being highlighted. Empowers students to engage as agents of change for those vulnerable populations affected by mental illness and/or substance use disorders.

SOWK 5125. Social Development in Malawi. (3) Cross-listed Course(s): SOWK 4125. Students actively participate in several pre-departure class lectures and work sessions. They travel to Malawi for 11 days and engage in service-learning activities aligned with social development in rural Malawi. Experiential projects are designed and implemented by students using funds they raise. Sustainability and anti-oppressive approaches to social development are highlighted.

SOWK 5126. Health and Well-Being in India. (3) Cross-listed Course(s): SOWK 4126, HLTH 4090, and HLTH 6090. This Study Abroad course covers topics related to health and well-being in India.

SOWK 5135. Social Work with HIV and AIDS. (3) The impact of HIV on social work client populations and emphasis on the need for social work practitioners and other helping professionals to be knowledgeable about the disease, prevention strategies, and related epidemiologic disparities. Addresses skills necessary to assist with needs of people living with HIV/AIDS, their significant others, families, and communities.

SOWK 5365. Grief and Loss over the Lifespan. (3) Cross-listed Course(s): GRNT 5365, GRNT 4365, and SOWK 4365. Equips the professional practitioner to understand and respond effectively to individuals, families, groups, organizations, and communities experiencing both symbolic and tangible losses and accompanying grief reactions. Topics include: theories of normal and complicated grief, factors that influence grief at different stages of the lifespan, cultural and spiritual influences, traumatic loss, anticipatory grief and end of life care, the impact of loss and working in close contact with grief on professionals, and skills and strategies that address therapeutic needs of vulnerable and resilient populations experiencing grief.

SOWK 6121. Social Work Practice: Theories and Skills. (3) Prerequisite(s): Enrollment in MSW or permission of department. Introduces the theories of human behavior and models of social work intervention necessary to engage all levels of client systems. Also introduces the skills necessary to identify, analyze, and implement evidence-based interventions to achieve client goals.

SOWK 6131. Social Work Research. (3) Prerequisite(s): Enrollment in MSW or permission of department. Introduction of social science research methods and their relevance to social work. Other content relates to the application of critical thinking and how to engage in research-informed practice and practice-informed research.

SOWK 6134. Family Caregiving Across the Lifespan: Theory, Research, and Policy. (3) Cross-listed Course(s): GRNT 6134 and SOCY 6134. Family caregiving is a lifelong process that occurs throughout one's life. Family care as a lifelong developmental construct is discussed, and students learn about current theoretical frameworks, areas of practice, education, research, and policy. A broad spectrum of care situations (from developmental disability to chronic illness, dementia care, and end of life) are examined and how caregivers and their families respond to these challenges. Provides insights and ideas for researchers, practitioners, and graduate students across the caregiving fields, including psychology, social work, public health, sociology, and others.

SOWK 6141. Foundations of Social Work. (3) Prerequisite(s): Enrollment in MSW or permission of department. Introduction to the profession of social work, with attention to social work history, social welfare history, and current social policies and programs that influence the

contexts of social work practice. Professional values, identity, and critical thinking are discussed in relationship to current and historical understandings of social problems and policy responses.

SOWK 6151. Social Work, Social Justice, and Diversity. (3) Prerequisite(s): Enrollment in MSW or permission of department. Examines individual, systemic, and ideological factors related to diversity and social justice. Theories and perspectives that contribute to understanding oppression and privilege are emphasized. Implications for social work practice, research, and policy are examined. Strategies to counter discrimination and oppression are identified. Requires considerable critical analysis and self-reflection on the part of participants.

SOWK 6171. Early Childhood Mental Health. (3) Highlights the relevance of early relationships between children and their parents, families, and other care providers to later health, mental health, and social adjustment. Emphasis on how the social environment and neuroanatomy during the earliest years of life interact to shape later functioning. Covers basic evidence-based prevention and interventions for young children and their caregivers. Students should have some familiarity with child developmental theory.

SOWK 6232. Practice and Program Evaluation. (3) Prerequisite(s): Enrollment in MSW or permission of department. Demonstrates how to engage in research-informed practice and practice-informed research. Managing client data and critically analyzing, monitoring, and evaluating interventions are covered in-depth.

SOWK 6242. Advocacy and Policy Change. (3) Prerequisite(s): Enrollment in MSW or permission of department. The role of advocacy in the social work profession, tools for bringing about policy change, and use of advocacy to promote social justice, especially for vulnerable populations.

SOWK 6252. Mental Health Assessment. (3) Prerequisite(s): Enrollment in MSW or permission of department. An overview of social work theories related to mental/behavioral health assessment with special emphasis on and critique of the APA *Diagnostic and Statistical Manual of Mental Disorders* (DSM).

SOWK 6441. Foundation Social Work Practicum I. (3) Prerequisite(s): Enrollment in MSW or permission of department. The Foundation field practicum prepares students to apply generalist social work knowledge, skills, values, and ethical principles gained in the classroom to social work practice. Students work in an approved field site under the supervision of a social work field instructor and attend a monthly seminar.

SOWK 6442. Foundation Social Work Practicum II. (3) Prerequisite(s): SOWK 6441; and enrollment in MSW or permission of department. The Foundation field practicum that prepares students to apply generalist social work knowledge, skills, values, and ethical principles gained in the classroom to social work practice. Students work in an approved field site under the supervision of a social work field instructor and attend a monthly seminar.

SOWK 6635. The Social Context of Mental Health. (3) Cross-listed Course(s): SOCY 6635, PSYC 8636, and PPOL 8636. Prerequisite(s): Admission to graduate program or permission of instructor. Draws upon contributions from the field of psychiatry, psychology, social work, and anthropology. The focus is on mental health and illness it is social context, with an emphasis on the relationship between social structure and mental health/disorder. Social factors are examined which shape psychiatric diagnosis, the effects of socio-demographic variables on mental health, and the role of social support and stress for different groups. Also examines the organization, delivery, and evaluation of mental health services, and mental healthcare policy.

SOWK 7090. Special Topics in Social Work. (3) A topics course that is only available for graduate credit. *May be repeated for credit with change of topic.*

SOWK 7114. Clinical Social Work: Ethics, Theories, and Application. (3) Prerequisite(s): SOWK 6252. Expands social work students' knowledge, values, and skills with regard to clinically focused social work. The course incorporates ASWB exam preparation, along with other assignments and resource links that are useful in the clinical realm.

SOWK 7120. Social Welfare and Philanthropy. (3) Introduction to philanthropy which allows students, through a community-based project, to experience two predominant aspects of philanthropy – grant making and fundraising – with an emphasis on supporting the well-being of vulnerable populations.

SOWK 7122. Advanced Social Work Practice with Individuals. (3) Prerequisite(s): Enrollment in MSW or permission of department. Expands social work students' knowledge, values, and skills with regard to advanced micro practice with individuals, especially members of vulnerable groups.

SOWK 7126. Advanced Social Work Practice with Groups. (3) Prerequisite(s): Enrollment in MSW or permission of department. Theory and practice related to social work with small groups. Various approaches to group development and facilitation, including social change, therapeutic change, goal setting, and assessment

in groups, with an emphasis on work with vulnerable populations.

SOWK 7127. Advanced Social Work Practice with Families. (3) Prerequisite(s): Enrollment in MSW or permission of department. Expands social work students' knowledge, values, and skills with regard to advanced micro practice with families, especially members of vulnerable populations.

SOWK 7130. Trauma and Recovery: Theory and Intervention. (3). The history and evolution of trauma theory and social movements, and exploration of the impact of trauma and healing upon survivors. Students master the foundational principles and basic skills of trauma intervention. Students also participate in a community project that involves learning about services available for trauma survivors locally.

SOWK 7140. Healthcare and Social Work. (3) Provides an understanding of the concepts of healthcare as applied to advanced social work practice in integrated health and behavioral healthcare settings. Examines social work roles, evidenced-based interventions, emerging issues, skill development, and issues related to interprofessional practice.

SOWK 7145. Management and Supervision. (3) Introduction to management and supervisory practice in social work. Emphasizes on how social work managers can improve program effectiveness by influencing organizations, staff, and the surrounding task environment.

SOWK 7146. Social Work Management and Leadership. (3) Introduces skills necessary to identify, analyze, and implement evidence-based social work executive management and leadership strategies. Provides practical content and strategies for management, business development, and strategic planning.

SOWK 7150. Social Work Practice with Military Veterans. (3) Students master the foundational principles and basic skills of assessing, and treating veterans in the community. Introduces several evidence-based practices shown to have positive outcomes with this population. Students actively participate to develop client-centered, strength-based approaches to treatment, with adherence to social work values and ethics. An emphasis is placed on the importance of competency, advocacy, and professionalism.

SOWK 7155. Advanced Mental Health Assessment. (3) Prerequisite(s): SOWK 6252. Expands upon mental health diagnostic, assessment, and treatment planning skills necessary for social work practice, including further exposure to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5).*

SOWK 7160. Social Work Practice with Latino Communities. (3) Enhances knowledge, values, and skills with regard to practice with Latino communities in the United States. Integrates an experiential education component that includes a combination of classroom, community, and independent work. Spanish proficiency is not required but may assist with course material and experience.

SOWK 7222. Advanced Social Work Practice with Organizations. (3) Prerequisite(s): Enrollment in MSW program or permission of department. Introduction to organizational theory, administration, and change in the context of social work practice. Develops advanced skills in engaging, assessing, intervening, evaluating, and leading organizational change efforts.

SOWK 7223. Advanced Social Work Practice with Communities. (3) Prerequisite(s): SOWK 7222; and enrollment in MSW program or permission of department. Builds advanced practice skills in engagement, assessment, intervention, and evaluation in community social work practice. Critically examines power, stakeholders, leadership, and resources in community change efforts.

SOWK 7443. Advanced Social Work Practicum I. (3) Prerequisite(s): SOWK 6442 (Advanced Standing students are exempt from this prerequisite); and enrollment in MSW or permission of department. The Advanced field practicum prepares students for more specialized application of social work knowledge, values, and skills, with special attention to the needs of vulnerable populations. Students work in an approved field site under the supervision of a social work field instructor and attend a monthly seminar.

SOWK 7444. Advanced Social Work Practicum II. (3) Prerequisite(s): SOWK 7443; and enrollment in MSW or permission of department. The Advanced field practicum prepares students for more specialized application of social work knowledge, values, and skills, with special attention to the needs of vulnerable populations. Students work in an approved field site under the supervision of a social work field instructor and attend a monthly seminar.

SOWK 7651. Reflection and Synthesis. (3) Prerequisite(s): SOWK 7222; SOWK 7443; and enrollment in MSW or permission of department. Provides MSW students with an opportunity to practice personal reflection, synthesize their learning from the MSW program, and demonstrate competency.

SOWK 7627. Seminar in Advanced Practice: Supervision and Staff Training. (3) Prerequisite(s): SOWK 6121, SOWK 6131, SOWK 6141, SOWK 6151, or admission to Advanced Standing program. Students may choose to satisfy their

social work elective requirement with this course. This seminar is for students who anticipate working in traditional social welfare organizations in the public or private sectors. The focus is on knowledge and skills that a social worker needs to succeed in practice in large organizations. Included is content on supervision, staff training and development, and the role of the professional in large organizations.

Spanish (SPAN)

SPAN 5011. Studies in Spanish American Prose Fiction. (3) Cross-listed Course(s): LTAM 5311. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of department. Studies of 19th and 20th century Spanish American prose fiction. *May be repeated for credit with change of topic.*

SPAN 5015. Studies in Regional Literature of the Americas. (3) Studies of Mexican, U.S. Latino/a, Central American, Caribbean, Andean, Amazonian, or Southern Cone literature, with readings from representative works. *May be repeated for credit with change of topic.*

SPAN 5016. Social, Political, Cultural, and Economic Issues in Hispanic Literature. (3) Contextual issues surrounding Hispanic literature. *May be repeated for credit with change of topic.*

SPAN 5050. Selected Topics in Spanish. (1 to 3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Consideration of a predetermined topic. *May be repeated for credit with change of topic.*

SPAN 5120. Advanced Business Spanish I. (3) Cross-listed Course(s): LTAM 5120. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Advanced studies in Business Spanish, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as economics, management, and marketing.

SPAN 5121. Advanced Business Spanish II. (3) Cross-listed Course(s): LTAM 5121. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Advanced studies in Business Spanish, intensive practice in speaking, listening comprehension, reading, writing, and translation in functional business areas such as marketing, finance, and import-export.

SPAN 5122: Studies in Advanced Business Spanish. (3) Cross-listed Course(s): LTAM 4322. Prerequisite(s): SPAN 3201, 3202, 3203, and 3220, or permission of the department. Advanced studies in special topics in Business Spanish (e.g., Tourism in Spain and Latin America, Free Trade in the Americas [NAFTA/TLCAN, Mercosur, The Andean Pact, CAFTA-DR], Socioeconomic Issues in the Greater Caribbean, Business and Technology in Latin America and Spain). *May be repeated for credit with change of topic.*

SPAN 5201. Nineteenth Century Spanish Literature. (3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Survey of Peninsular literature from Costumbrismo through the Generation of 1898. Lectures, discussions, and reports.

SPAN 5202. Twentieth Century Spanish Literature. (3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Treatment of major literary developments from the Generation of 1898 to present day. Lectures, discussions, and reports.

SPAN 5205. Novel of the Golden Age. (3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. El Lazarillo through El Criticón. Lectures, discussions, and reports.

SPAN 5206. Theater of the Golden Age. (3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Study of works of the leading dramatists of the period. Lectures, discussions, and reports.

SPAN 5210. Studies in Spanish American Poetry. (3) Cross-listed Course(s): LTAM 5310. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Studies of 19th and 20th century Spanish American poetry.

SPAN 5212. Studies in Spanish American Theater. (3) Cross-listed Course(s): LTAM 5312. Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of the department. Studies of 20th century Spanish American theater.

SPAN 5213. Cervantes. (3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, or permission of department. Study of Cervantes' masterpiece *Don Quixote*, as well as his other works.

SPAN 5410. Professional Internship in Spanish. (1 to 6) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish, and permission of the department. Faculty-supervised field and/or research experience in a cooperating profession (e.g., business) or community organization. Contents of internship based upon a contractual agreement among the student, department, and business or community organization. *Graded on a Pass/Unsatisfactory basis.*

SPAN 5800. Directed Individual Study. (1 to 3) Prerequisite(s): Post-baccalaureate status, B.A. in Spanish or permission of the department. Individual work on a

selected area of study. To be arranged with the instructor, generally during the preceding semester. By special permission only. *May be repeated for credit.*

SPAN 6001. Advanced Studies in Spanish Language. (3) Selected topics in Spanish linguistics. Topics may include a) history of the Spanish language; b) introduction to Spanish phonology and morphology; and c) Spanish dialectology. *May be repeated for credit with change of topic.*

SPAN 6003. Studies in Hispanic Culture and Civilization. (3) Selected topics on the civilization and culture of the Spanish-speaking world. Possible emphases include 1) the press in Spanish America; 2) song texts of the Hispanic world; 3) Spanish cinema; 4) Spain since Franco; 5) Hispanics in the United States. *May be repeated for credit with change of topic.*

SPAN 6005. Advanced Studies in Spanish Literature. (3) Study of selected works and writers from Spain. *May be repeated for credit with change of topic.*

SPAN 6007. Advanced Studies in Spanish American Literature. (3) Cross-listed Course(s): LTAM 6307. Study of selected works, writers, literary genres, periods, and schools from Spanish America. *May be repeated for credit with change of topic.*

SPAN 6201. Hispanic Language and Culture through Media. (3) In-depth study of contemporary Hispanic culture and language through media sources, including print, radio, film, Internet, and television. The course provides cultural exposure, and practice in written and oral communication, and training in the use of technology--assisted instruction. *May be repeated for credit with change of topic.*

SPAN 6901. Advanced Project. (1 to 3) Appropriate research and written exposition of that research. The proposed project, as well as the final product, will be approved by a committee of three faculty members appropriate to the topic, appointed by the Department Chair after consultation with the student and the Graduate Program Director, on the basis of a written proposal from the student. *May be repeated for credit with change of topic.*

SPAN 6902. Thesis. (1 to 6) Appropriate research and written exposition of that research. The proposed project, as well as the final product, will be approved by a committee of three faculty members appropriate to the topic, appointed by the Chair of the Department after consultation with the student, on the basis of a written proposal from the student. (A statement of recommendations and requirements for form and procedure is available in the office of the Department of Languages and Culture Studies.) *Graded on a Satisfactory Progress/Unsatisfactory Progress or Standard Letter Grade basis each term. May be repeated for credit up to 6 credit hours.*

Special Education (SPED)

SPED 5000. Topics in Special Education. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

SPED 5100. Introduction to Special Education. (3). Prerequisite(s): Admission to Teacher Education. Examines legislation and litigation that governs and/or influences services for individuals with disabilities. Scrutinizes the IEP process and investigates IEP objectives that reflect the general curriculum standards. Examines one's personal philosophy of education, which reflects the diversity of students with disabilities. Identifies services, networks, organizations, and publications that serve or are relevant to individuals with disabilities. Identifies and critiques instructional implications of published research.

SPED 5111. Issues in Early Intervention for Young Children with Disabilities. (3) Prerequisite(s): Admission to Teacher Education, and a GPA of 2.5 or above. Explores issues and evidence-based practices for young children with disabilities and their families in home, school, and community settings.

SPED 5112. Authentic Approaches to the Assessment of Young Children with Disabilities: Birth-Kindergarten. (3) Prerequisite(s): Admission to Teacher Education, GPA of at least 2.5, and SPED 5111. Develops competence in evaluation, design, implementation, and interpretation of culturally appropriate, interdisciplinary assessment approaches within the context of the young child's natural environments and in partnership with families that lead to appropriate intervention plans for children with disabilities. A field-based clinical assignment of approximately 20 hours is required.

SPED 5173. Diagnostic Assessment. (3) Prerequisite(s): Admission to Teacher Education. Provides an overview of the principles and practice of educational problem solving with an emphasis on formal/standardized assessment, including curriculum-based assessment and curriculum-based measurement; special education eligibility; linkages between assessment and instruction; and concepts in educational assessment of students with exceptional learning needs (ELN). Topical paper required.

SPED 5175. Instructional Planning in Special Education. (3) Prerequisite(s): Admission to Teacher Education. This introductory course addresses strategies for the development, implementation, and monitoring of

Individualized Education Programs (IEPs) and related instructional planning for P-12 students with disabilities within the general curriculum (high incidence disabilities) or adapted curriculum (low incidence disabilities). Through this course, students are expected to demonstrate proficiency in using the general education curriculum to develop appropriate IEPs and lesson plans for instruction.

SPED 5200. Concepts and Principles of Behavior Analysis. (3) Introduction to the basic principles by which humans learn social, academic, physical, and other skills. The primary goal is to provide students with a complete, accurate, and contemporary view of behavior analysis, and how this approach can be used to change socially significant behaviors for individuals, especially those with special needs.

SPED 5201. Science and Philosophy in Behavior Analysis. (3) Prerequisite(s): SPED 5200. Introduction to the philosophical and scientific foundations underpinning behavior analytic perspectives and practices. Students acquire competencies related to the history of behavior analysis, behaviorism, radical behaviorism, and key characteristics of applied behavior analysis.

SPED 5202. Supervision and Consultation in Behavior Analytic Programming. (3) Prerequisite(s): RSCH 7113, SPED 5200, SPED 5201, and SPED 6502. Explores competencies related to the supervision of staff, including consultation in schools, clinics, home, and other treatment environments, and collaboration with professionals across disciplines and families.

SPED 5203. Ethics, Compliance, and Professionalism in Behavior Analysis. (3) Prerequisite(s): SPED 5200, SPED 5201, SPED 6502, and RSCH 7113. Introduction to the Professional and Ethical Compliance Code for Behavior Analysts. Students acquire competencies across a range of topics related to ethical practice by behavior analysts.

SPED 5210. Developmental Interventions for Young Children with Disabilities: Birth through Kindergarten. (3) Prerequisite(s): Admission to Teacher Education; GPA of at least 2.5 overall; SPED 5111; and SPED 5112. Focuses on developing, facilitating, and evaluating incidental learning and play, and routines-based interventions with young children with disabilities and their families. A field-based clinical assignment of approximately 20 hours is required.

SPED 5211. Nature and Needs of Gifted Students. (3) Examination of the historical and philosophical perspectives of education for gifted and talented learners with emphasis on answering the question "What is giftedness?" Issues explored in the course include identification procedures, instructional options, the nature of intelligence and creativity, laws/policies, psychological and emotional correlates of talent, and current research findings.

SPED 5270. Classroom Management. (3) Prerequisite(s): Admission to Teacher Education. Equips students with the knowledge and skills of applied behavior analysis (ABA) as an approach for programming effective interventions for children and youths with disabilities. It focuses specifically on "positive behavior support" (PBS), a research-validated approach to interventions designed to prevent problem behavior, encourage environmental management, and promote students' positive and appropriate behavior. Prepares students to conduct a functional behavioral assessment (FBA) in order to more efficiently and effectively identify the interventions to address the students' behavioral needs. The desired outcomes of this course are for students to have a basic understanding of ABA, FBA, and PBS as well as to apply these principles in a classroom setting for students with disabilities.

SPED 5271. Systematic Instruction. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; SPED 5173; and SPED 5270. Principles and procedures used to program instruction for persons with severe disabilities are presented and evaluated as to their effectiveness. Students are required to design and implement an instructional program for students with severe disabilities.

SPED 5272. Teaching Mathematics to Learners with Special Needs. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; SPED 5173; and SPED 5175. Effective teaching strategies and materials in math for learners with special needs for teacher licensure in Special Education: General Curriculum as stipulated by the North Carolina Department of Public Instruction. A 12-hour field-based clinical experience is a required component of the course. Assessment and application of instructional techniques are included.

SPED 5274. General Curriculum Access and Adaptations. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5173, SPED 5300, and SPED 5370. Provides strategies for developing curricular priorities for students who need adaptations to the general curriculum including ways to link to state standards in reading, math, writing, science, and other content areas. Supports teachers seeking licensure in Special Education: Adapted Curriculum (NCDPI). A directed field experience is a required component (approximately 12 hours).

SPED 5275. Teaching Reading to Elementary Learners with Special Needs. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; SPED 5173; and SPED 5175. Effective prevention and intervention strategies for addressing the needs of elementary students with disabilities and diverse

learning needs. Assessment and application of instructional strategies are included in the course. A semester long 12-hour field experience is a required component.

SPED 5276. Teaching Reading to Middle and Secondary Learners with Special Needs. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program, SPED 5100, SPED 5173, SPED 5175, and SPED 5270. Provides effective remedial and intervention strategies for addressing the needs of middle and secondary students with disabilities and diverse learning needs. Assessment and application of instructional strategies are included in the course. Clinical field experience hours required.

SPED 5277. Teaching Written Expression to Learners with Special Needs. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; SPED 5173; and SPED 5175. Provides students with effective teaching strategies and materials in written expression to learners with special needs. A 12-hour field experience is a required component of the course. The field experience includes assessment and application of instructional techniques with students identified as receiving special education services. Designed to address core and specific competencies in teaching written expression to students with special needs for teacher licensure in Special Education: General Curriculum as stipulated by the North Carolina Department of Public Instruction.

SPED 5278. Instructional Planning for Students in the Adapted Curriculum. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; SPED 5173; and SPED 5270. Addresses strategies for the development, implementation, and monitoring of Individualized Education Programs (IEPs) and related instructional planning for P-12 students with disabilities within the adapted curriculum (low incidence disabilities). Through this course, students are expected to demonstrate proficiency in developing appropriate IEPs. Additionally, this course provides strategies for lesson planning that include collaborative instruction, Universal Design for Learning, and instructionally relevant use of computer-based technology. Implementation of at least one lesson plan is included. A 10-hour field experience is a required component.

SPED 5279. Content-Area Instruction for Students with Special Needs. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate program; SPED 5100; SPED 5173; SPED 5175; SPED 5270; SPED 5272; SPED 5275 or SPED 5276; and SPED 5277. Provides strategies for collaborative instruction, instructionally relevant use of computer-based technology, and strategic instruction to improve access of students with disabilities in the general curriculum with an emphasis on content-area instruction at the middle and secondary levels: English, science, social studies, and mathematics. Application of instructional strategies are included in the course. A semester long 10-hour field experience is a required component.

SPED 5280. Multiple Disabilities. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate program; SPED 5100; SPED 5173; and SPED 5270. Describes various secondary disabling conditions that sometimes occur in conjunction with intellectual disability such as physical disabilities, sensory disabilities, and other health impairments. Assessment, instructional methods and procedures, and collaborative service delivery with related services personnel are studied. A field-based clinical assignment of approximately 12 hours is required.

SPED 5300. Lifespan Development for Exceptional Individuals. (3) Prerequisite(s): Admission to COED Teacher Education program. Topics in special education (SPED) that support concepts and skills for early SPED professionals and others who serve exceptional individuals. Examines legislation and litigation that govern and/or influence services for exceptional individuals. Various areas of exceptionality are addressed with applications for service delivery and programming. The course also emphasizes the importance and relevance of diversity in today's schools. Candidates study student and family transitions from early childhood to post-secondary options. Identifies services, networks, organizations, and publications that serve or are relevant to exceptional individuals.

SPED 5316. Transition Planning and Service Delivery. (3) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program; SPED 5100; and SPED 5173. Methods and procedures used in preparing students with disabilities for post school adjustment including employment, leisure, residential, and continuing educational opportunities are studied. A field-based clinical assignment is required.

SPED 5370. Culturally Responsive Positive Behavior Support. (3) Equips students with the knowledge and skills to access, plan, and evaluate culturally responsive, positive behavioral supports based on students' Individualized Education Program goals and objectives. Prepares students to design a positive classroom environment, as well as provides individual supports for students with behavioral challenges.

SPED 5371. Person-Centered Planning within Inclusive Classrooms for Students with Extensive Support Needs. (3) Prerequisite(s): SPED 6225, SPED 6390, and admission to the M.A.T. in Special Education program. Provides content

and context related to the development of inclusive opportunities and experiences for students who have extensive support needs. Topics include: developing supports within inclusive school and community environments and with a range of team members, arranging peer supports, working with families, and capitalizing on post-school environments and experiences. A major component of the course is engaging in a person-centered planning process to develop a supports plan designed to promote meaningful inclusive experiences for an individual with extensive support needs. This clinical experience may take place in either a school or community setting.

SPED 5372. Planning Mathematics Instruction for Students with Exceptional Needs. (3) Prerequisite(s): SPED 5173, SPED 5300, and SPED 5370, and admission to COED Teacher Education program. Provides strategies for (a) assessing students' mathematics performance, (b) applying mathematics standards, student needs, strengths, and weaknesses, and IEP goals to mathematics lesson planning, (c) utilizing evidence- and research-based instructional practices, and (d) integrating technology into lesson plans for teacher licensure in Special Education: General Curriculum (NCDPI). A directed field experience is a required component (approximately 12 hours).

SPED 5375. Foundations of Literacy for Students with Diverse Learning Needs. (3) Prerequisite(s): SPED 5173, SPED 5300, and SPED 5370. Provides effective beginning prevention and intervention strategies for addressing the literacy needs of students with disabilities and diverse learning needs. Also includes assessment and application of instructional strategies. Supports teachers seeking licensure in Special Education: General Curriculum (NCDPI). A directed field experience is a required component (approximately 12 hours).

SPED 5377. Advanced Literacy for Students with Diverse Learning Needs. (3) Prerequisite(s): Admission to the M.A.T. in Special Education program. Effective advanced prevention and intervention strategies for addressing the literacy needs of students with disabilities and diverse learning needs. Assessment and application of instructional strategies are included. A field experience is a required component.

SPED 5379. Diversity and Disability in the Inclusive Classroom. (2) Prerequisite(s): Admission to the M.A.T. in Special Education program. An increased depth of knowledge of the general curriculum standards and curricular expectations impacting education of a diverse population of children with special needs in inclusive classrooms. Provides strategies for collaborative instruction, academic language, culturally and linguistically responsive instructional (CLRI) practices, instructionally relevant use of computer-based technology, content enhancement, and strategic instruction to improve access of students with special needs included in content-area (English, science, social studies, and mathematics) instruction at the intermediate, middle, and secondary levels (grades 4-12). Application of instructional strategies are included in the course and a field experience is required.

SPED 5380. Multiple Disabilities and Systematic Instruction. (3) Prerequisite(s): SPED 5173, SPED 5300, and SPED 5370. Describes various secondary conditions that sometimes occur in conjunction with intellectual disability such as physical disabilities, sensory disabilities, and other health impairments. Topics include: assessment, instructional methods and procedures, and collaborative service delivery with related services personnel. Supports teachers seeking licensure in Special Education: Adapted Curriculum (NCDPI). A field-based clinical assignment in which students design and implement an instructional program for a student with multiple disabilities is required (approximately 12 hours).

SPED 5400. Practicum: Integrated Instructional Applications in Special Education. (3) Pre- or Corequisite(s): SPED 5370; and SPED 5375 (for General Curriculum) or SPED 5380 (for Adapted Curriculum). Candidates develop and apply knowledge of varied learner needs by planning and implementing lessons that align to state standards in academic content areas designed to meet the individual needs of students with disabilities. Additionally, candidates analyze student outcome data and make instructional decisions for subsequent lessons. Candidates receive extensive coaching and feedback of instructional and behavioral strategies within the course and school site classroom. Candidates are expected to apply feedback during instruction (rehearsal and clinical application). This is a clinical intensive course requiring extensive classroom experience.

SPED 6000. Topics in Special Education. (1 to 6) Prerequisite(s): Admission to Teacher Education and Special Education Graduate Certificate Program. May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

SPED 6111. Advanced Issues in Early Intervention/Early Childhood Special Education (EI/ECSE). (3) In-depth exploration of issues and evidence-based practices for young children with diverse abilities and their families in home, school, and community settings. Emphasis on current research, developmental/educational implications of disabilities, and leadership in early intervention and early childhood special education.

SPED 6115. Introduction to Autism Spectrum Disorder. (3) Prerequisite(s): Admission to the M.A.T. in Special Education

program, admission to the M.Ed. in Special Education and Child Development Program, admission to the Graduate Certificate in Autism Spectrum Disorder program, or being admitted as a post-baccalaureate student. An introduction to the history, and cultural and individual impacts of autism spectrum disorder (ASD), and systems of support for individuals with ASD and their families. Students learn to distinguish between research-based and fad or pseudoscientific information related to ASD and interventions for this population.

SPED 6124. Methods of Instructing Gifted Students. (3) Pre- or Corequisite(s): SPED 5211. An introduction to the basic skills necessary to plan, implement, and evaluate instructional procedures that facilitate learning by gifted students. Specific theories discussed include those by Bloom, Kaplan, Parnes, Renzulli, and VanTassel-Baska.

SPED 6161. Social and Emotional Needs of Gifted Students. (3) An overview of current theory and practice in understanding gifted students' social and emotional development. Topics range from the social and emotional needs of the general population of gifted students to the unique needs of specific sub-groups of gifted students (e.g., gifted girls, gifted and learning disabled, gifted minority students).

SPED 6224. Adapting Curriculum Materials and Classroom Differentiation. (3) Pre- or Corequisite(s): SPED 5211, SPED 6124, and SPED 6161. Students study methods of making accommodations to meet the gifted student's needs in the regular classroom. Topics include: differentiated lesson plans based on national and state standards as well as methods of adapting the learning environment to support multi-level learning.

SPED 6225. Behavior Analytic Intervention in Communication. (3) Prerequisite(s): A bachelor's degree from an accredited college or university in education or related field of study. Provides a behavior analytic lens, rooted in Skinner's analysis of verbal behavior, through which to view communication development and intervention. Students learn to conduct behavioral communication assessments and implement research-based interventions for teaching early learning and communication skills to individuals with autism spectrum disorder (ASD) and other disabilities. In addition, students learn how to select and design augmentative and alternative communication systems for use with non-vocal students and to collaborate with families and other professionals to facilitate the design of high quality programming.

SPED 6241. Advanced Curriculum for Gifted Students. (3) Models of curriculum design for academically or intellectually gifted students. Emphasis on integrating philosophy of teacher, school, and community with child characteristics to create the appropriate course of study in a variety of school settings.

SPED 6242. Enhancing Communication and Supporting Behaviors in Inclusive Settings: B-K. (3) Pre- or Corequisite(s): CHFD 6102 and CHFD 6210. Provides professionals with in-depth knowledge regarding theories, evidence-based strategies, and best practices to provide effective social-communication interventions and support challenging behaviors of young children in inclusive settings.

SPED 6270. Gifted Assessment and Program Evaluation. (3) Prerequisite(s): SPED 6161 and SPED 6224, or permission of instructor. This advanced course introduces the theory and practice behind structuring programs for gifted students, from legal mandates to assessment considerations, program design, and evaluation of students and programs. Evaluation of gifted programming provides experience applying the frameworks presented in current North Carolina and national standards.

SPED 6272. Program Design and Development for Autism Spectrum Disorders. (3) Prerequisite(s): SPED 6115 and SPED 6225. Prepares students with the technical skills necessary to conduct formal assessments, implement research-based interventions, and evaluate outcomes for individuals with autism spectrum disorders. Identify methods for planning systematic instruction based on learner characteristics based on previous and on-going assessment. Gain knowledge of home environments, family interventions and general curriculum access with an emphasis on appropriate strategies, materials, and supports in program design and development that facilitate the success of students with autism spectrum disorders across the lifespan.

SPED 6277. Program Assessment for Autism Spectrum Disorders. (3) Prerequisite(s): SPED 6115 and SPED 6225. Prepares students to assess the effectiveness of interventions for students with autism spectrum disorders in accordance to researched-based practices and promising practices. Interpret and apply individualized educational program assessment data to drive program recommendations, services, appropriate interventions, and IEP development for students with autism spectrum disorders.

SPED 6335. Evidence-Based Practices for Learners with Autism Spectrum Disorder. (3) Prerequisite(s): SPED 6115. Prepares students with the skills necessary to identify, implement, and evaluate the effectiveness of evidence-based practices for individuals with autism spectrum disorder. This course prepares students to recognize factors that influence how special education professionals make decisions regarding what interventions and strategies to use, to implement an evidence-based

practice to meet the needs of an individual with autism spectrum disorder and interpret and apply behavioral observation data, and to evaluate how evidence-based practices may best meet the complex needs of individuals with autism spectrum disorder across the lifespan.

SPED 6350. Young Children with Disabilities and their Families: Interdisciplinary Collaboration. (3) Pre- or Corequisite(s): CHFD 6102 and CHFD 6220. Explores issues and evidenced based practices specific to forming family-professional partnerships and collaborating across disciplines (e.g., early intervention/early childhood special education (EI/ECSE), early childhood education, occupational therapy, physical therapy, speech and language therapy, social work, nursing, public health, and education) to address the complex needs of young children with disabilities (or at-risk of developmental delays) and their families in natural and/or least restrictive environments (e.g., home, school, community settings, and hospitals).

SPED 6390. Collaboration and Transition-Focused Education. (2) Prerequisite(s): Admission to the M.A.T. in Special Education program. Provides special educators with advanced knowledge relating to: (a) the roles of parents, paraeducators, administrators, other professionals, and students on multi-disciplinary teams; (b) initiatives in building inclusive programs; and (c) the array of services available to children with disabilities, in preparation for post-school success. The course enhances skills to: (a) effectively communicate for collaboration; (b) promote family involvement, including engagement of families from culturally diverse backgrounds; and (c) collaboratively plan and deliver instruction in school or community settings.

SPED 6471. Internship: Academically or Intellectually Gifted. (3) Prerequisite(s): SPED 5211, SPED 6124, SPED 6641, and permission of department. Supervised experiences in observation, instruction, and administration of programs with gifted and talented students. *Graded on a Pass/Unsatisfactory basis.*

SPED 6475. Internship/Seminar: Special Education K-12 - General Curriculum. (3 to 6) Prerequisite(s): Admission to Special Education Graduate Certificate Program and grade of C or higher in all licensure courses; Application for SPED internship. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

SPED 6476. Internship/Seminar: Special Education K-12- Adapted Curriculum. (3 to 6) Prerequisite(s): Admission to Special Education Graduate Certificate Program and grade of C or higher in all licensure courses; Application for internship. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

SPED 6502. Behavioral Assessment. (3) Prerequisite(s): Admission to the M.A.T. (Phase II) or M.Ed. in Special Education program. Advanced theoretical context, including applied behavior analysis, functional assessments, and positive behavioral supports, and related applied strategies necessary to effectively address the classroom behaviors of individuals or groups of students. A field-based assignment of approximately 15 hours is required.

SPED 6503. Instructional Design in Special Education. (3) Prerequisite(s): Admission to the M.A.T. (Phase II) or M.Ed. in Special Education program. Advanced instructional design for learners who have significant difficulty in performing academic tasks with typical instruction. Provides students with a unified set of viable instructional design principles for evaluating or modifying curriculum. Application of these principles ensures that the curriculum is accessible to a diverse group of learners. A field-based assignment of approximately 15 hours is required.

SPED 6637. Theory and Development of Creativity. (3) Prerequisite(s): SPED 6161 and SPED 6224, or approval of instructor. Provides an exploration of the concept of creativity: its components, its measurement, and its application to education. Topics discussed in class range from the theoretical (what is creativity? what does it look like?) to the practical (what activities can be used to develop creative behaviors in the classroom setting?). Includes opportunities to prepare materials to be used with small groups of children.

SPED 6641. Seminar in Curriculum Development: Gifted and Talented. (3) Procedures and suggestions for developing programs for academically or intellectually gifted learners; philosophy of the teacher; school and community assumptions of curriculum; child characteristics; parental concerns; teaching styles.

SPED 6690. Consultation and Collaboration. (2) Prerequisite(s): Admission to the M.A.T. (Phase II) in Special

Education program. Special educators must be able to build effective partnerships with families, general educators, paraeducators, and related service professionals in order to assure comprehensive and quality programs for children with disabilities. Provides special educators with knowledge relating to the role of parents, paraeducators, administrators, other professionals, and students on multi-disciplinary teams, initiatives in building inclusive programs, and the array of services available to children with disabilities. Provides skills in effective communication; promoting family involvement, including families who are culturally diverse; team planning; collaborative instruction; and leadership. Enhances the view of special educators as specialists and a resource to colleagues for instruction, inclusion, transition, and collaboration with outside agencies.

SPED 6691. Seminar in Professional and Leadership Development. (1) Prerequisite(s): Admission to the M.A.T. in Special Education program; SPED 6502; SPED 6503; and RSCH 7113. Pre- or Corequisite(s): SPED 6690. Designed to support graduate students in the design, implementation, and write up of their Data-based Decision Project, required for M.A.T. in Special Education candidates. This project involves the candidate implementing (in a school setting) an academic or behavioral intervention with one or more students using a single subject research methodological design and support/mentor a colleague to implement a similar intervention with other students. The resulting product serves as the capstone project for the M.A.T.

SPED 6692 Research Proposal. (2) Prerequisite(s): An "A" level special education teaching license, admission to the M.Ed. in Special Education, SPED 6502, SPED 6503, and RSCH 7113. Provides evidence that a candidate can conceptualize and design a single subject research study and supports the development of the capstone project required for M.Ed. in Special Education candidates. Candidates must complete the University's Institutional Review Board (IRB) Research with Human Subjects online tutorial, submit a research protocol application, and receive IRB approval prior to implementing the study. This course is not a traditional, instructor-taught course sequence, but is directed by the candidate's academic advisor and supported by another faculty committee member. (*Fall, Spring*)

SPED 6693. Research Implementation. (2) Prerequisite(s): SPED 6692. Provides evidence that a candidate can implement a single subject research study and supports the development of the capstone project required for M.Ed. candidates in special education. This course is not a traditional, instructor-taught course sequence, but is directed by the candidate's academic advisor and supported by another faculty committee member.

SPED 6694. Research Dissemination and Leadership. (2) Prerequisite(s): SPED 6693. Provides evidence that candidates develop necessary skills and dispositions to assume the roles and responsibilities of collaborative leaders in schools and communities; demonstrate leadership in their classrooms, school, and professional organizations; and advocate for students and effective educational practices and policies. Candidates produce a written report of a research study and deliver a workshop for their school colleagues. The workshop includes a report of the research results and implications for addressing a problem or issue in the school. This course is not a traditional, instructor-taught course sequence, but is directed by the candidate's academic advisor and supported by another faculty committee member.

SPED 6695. Research Proposal in AIG. (3) Provides evidence that a candidate can conceptualize and design a research study using a recognized research design, and it supports the development of the capstone research project required for M.Ed. candidates in AIG. Candidates complete the University's Institutional Review Board (IRB) Research with Human Subjects online tutorial, develop and submit a research protocol application, and submit their application for IRB approval prior to implementing the study in SPED 6696.

SPED 6696. Research Implementation in AIG. (3) Candidates implement a research study using a recognized research design that they have designed in SPED 6695 and will produce a written report to disseminate their findings to stakeholders. Allows students to complete the capstone project requirement for M.Ed. candidates in the area of Academically or Intellectually Gifted.

SPED 6800. Individual Study in Special Education. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

SPED 8271. Single Subject and Qualitative Research in Special Education. (3) In-depth study of single-subject and qualitative research methods as they apply to the field of special education including data collection, research designs, data display and analysis, and writing research reports.

SPED 8471. Professional Writing in Special Education. (2) Introduces the forms of professional writing expected of leaders in special education. Emphasis is placed on critical thinking, practice writing, and peer assessment.

SPED 8472. Research Implementation in Special Education. (2) The process of conducting applied research in special education. Students design and implement a research study in collaboration with a faculty member.

SPED 8473. Grant Writing in Special Education. (2) An experiential course in conceptualizing and developing applications for federal, state, local, and private grant funding for research and innovation efforts. A strong emphasis will be placed on applications for federal and state funding with a secondary focus on applications for corporate and private foundation funds.

SPED 8474. Supervision of Student Teachers in Special Education. (3) An internship experience. The course includes seminar sessions and concentrated practice in supervision of special education student teachers under direct faculty supervision.

SPED 8475. College Teaching in Special Education. (3) Issues and concepts in teaching adults and preparing special educators are applied in this college teaching experience. Supports students as they teach and/or co-teach University courses. *May be repeated for credit up to 15 credit hours.*

SPED 8476. Doctoral Internship in Special Education. (3 to 6) Supplements students' specialty areas through leadership experiences in a field related to or impacting special education (i.e., government, school district, agency). Provides students with an opportunity to explore their leadership skills in a new role within a field-based setting with the supervision of a mentor. *May be repeated for credit up to 6 credit hours.*

SPED 8477. Teacher Preparation in Online Settings. (3) Presents techniques and supervised practice in the supervision and instruction of adult learners in online learning environments in college or school system settings. Also provides applied practice in course construction and development in selected learning management systems.

SPED 8670. Advanced Research Topics in Special Education. (3) In-depth study of a topic(s) in special education research which addresses current issues in the field of special education.

SPED 8671. Doctoral Seminar in Special Education Research. (3) An intensive overview of the major research designs used in Special Education including group designs, single subject designs, survey research, qualitative research, and program evaluation. Introduces students to the research interests of the faculty.

SPED 8672. Doctoral Seminar in Leadership in Special Education. (3) An intense review of the history, landmark events, professional organizations, and seminal articles in the field of special education and related disciplines. Also includes substantial coverage of federal and state policies, IDEA, and special education law. Prepares students to build professional leadership skills in areas such as time management, systematic planning, team leadership, and communication.

SPED 8673. Doctoral Seminar in Diversity and Collaboration. (3) Advanced study of systems change related to educating students with disabilities who are culturally and linguistically diverse including understanding the meaning of diversity, appreciation of cultural values, principles for working with diverse families, and methods for collaboration. Addresses CEC Multicultural Standards and prepares students to develop culturally responsive instruction for schools, community, and college contexts. Enrollment limited to Ph.D. students in Special Education.

SPED 8674. Doctoral Seminar in Teaching in Special Education. (3) Presents techniques used in the supervision and instruction of adult learners in college or school system settings. Also provides an intensive overview of current, empirically supported strategies for the instruction of learners across disability areas as an important knowledge base for leadership and college teaching roles in special education.

SPED 8675. Special Education Doctoral Seminar in Applied Behavioral Analysis. (3) Advanced study of concepts, principles, and strategies in applied behavioral analysis. Prepares students in the conceptual and technical skills necessary to change socially significant behavior.

SPED 8676. Doctoral Seminar in Policy Analysis. (3) Advanced study of contemporary and historical issues in federal, state, and local educational policy, with a focus on policy related to high-achieving and academically gifted children. Also prepares students to engage in advocacy efforts and develop effective policy recommendations to meet the needs of children identified as academically or intellectually gifted.

SPED 8699. Dissertation Proposal Seminar in Special Education. (2) Identification and definition of a research area and development of a proposal draft for an original research study appropriate for dissertation requirement.

SPED 8800. Independent Study in Special Education. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

SPED 8999. Dissertation Credits. (3, 6, or 9) Development, implementation, and evaluation of an original research study that addresses the needs of exceptional learners. *Graded on a Satisfactory Progress/Unsatisfactory Progress basis each term.*

Statistics (STAT)

STAT 5110. Applied Regression Analysis. (3) Cross-listed Course(s): DSBA 5110. Prerequisite(s): MATH 2164; and STAT 2122, STAT 3128, or equivalent; or permission of department. Theoretical and practical training in statistical modeling with particular emphasis on the application of linear regression and multivariate statistical analysis. The basic fundamentals and statistical inference techniques associated with regression models are introduced. Students also learn how to apply the statistical techniques to extract information from data generated in various application areas using statistical software. Topics include: linear regression, model adequacy checking and diagnostics, generalized linear regression, and multivariate statistical analysis.

STAT 5123. Applied Statistics I. (3) Cross-listed Course(s): HCIP 5123. Prerequisite(s): MATH 2164 with a grade of C or above or permission of department. Review of stochastic variables and probability distributions, methods of estimating a parameter, hypothesis testing, confidence intervals, contingency tables. Linear and multiple regression, time series analysis.

STAT 5124. Applied Statistics II. (3) Prerequisite(s): STAT 5123 or permission of department. Single factor analysis of variance. Multi-factor analysis of variance. Randomized complete-block designs, nested or hierarchical designs, Latin squares, factorial experiments. Design of experiments.

STAT 5126. Theory of Statistics I. (3) Prerequisite(s): STAT 3123 or permission of department. Survey of the mathematical structure supporting applied statistics. Discrete and continuous distributions, moment-generating functions, sampling, point estimation, the multivariate normal distribution, sampling distributions.

STAT 5127. Theory of Statistics II. (3) Prerequisite(s): STAT 5126 or permission of department. Point and interval estimations, hypothesis testing, regression and linear hypotheses, experimental designs and analysis, distribution-free methods.

STAT 5227. Loss Models and Applications. (3) Cross-listed Course(s): STAT 4227. Prerequisite(s): MATH 2241; and MATH 3122 or STAT 3122; or approval of department. Review of the key features of insurance and reinsurance; severity, frequency, and aggregate loss models; parametric estimation; model selection.

STAT 6027. Topics in Statistics. (3) Prerequisite(s): Permission of department. Topics chosen from applied statistics applicable to other disciplines.

STAT 6108. Probability and Statistics for Secondary Mathematics Teachers. (3) Cross-listed Course(s): MATH 6108. Prerequisite(s): Admission into the M.S. in Mathematics with Concentration in Mathematics Education program. Topics from probability and statistics appropriate for high school mathematics teachers. Topics in probability include: discrete and continuous random variables, probability distributions, sums and functions of random variables, the law of large numbers, and the central limit theorem. Topics in statistics include: sample mean and variance, estimating distributions, correlation, regression, and hypothesis testing.

STAT 6113. Cross-Section and Time-Series Econometrics. (3) Cross-listed Course(s): ECON 6113. Prerequisite(s): permission of department. Introduces the advanced study of the theory and application of statistics to economic problems. Topics include: derivation of the least-squares estimator; methods with which to detect and correct for potential problems with the classical regression model; maximum likelihood estimation; instrumental variables regression; the problems with multicollinearity, heteroscedasticity, and autocorrelation; introduction to the time-series estimation, including ARIMA models and basic forecasting tools.

STAT 6115. Statistical Learning with Big Data. (3) Cross-listed Course(s): DSBA 6115. Prerequisite(s): DSBA 5110, STAT 5110, STAT 5123, or permission of department. A survey of major statistical learning concepts and methods for big data analysis, including both supervised and unsupervised learning such as resampling methods, support vector machines, model selection and regularization, tree-based methods and ensembles, and statistical graphics. Students learn how and when to apply statistical learning techniques, their comparative strengths and weaknesses, and how to critically evaluate the performance of learning algorithms in case studies in financial investment, gene identification, and feature selection in high-dimensional spaces.

STAT 6127. Introduction to Biostatistics. (3) Prerequisite(s): MATH 1100 and STAT 1221or permission of department. Descriptive statistics and exploratory data analysis; basic probability models and the concept of random variables; point and interval estimation; hypothesis testing (one- and two-sample problems); simple linear regression and ANOVA; selection of appropriate methods for analysis; development of skills to conduct analysis of data; development of the capability to present the results of a study in scientific language.

STAT 6228. Short-Term Actuarial Mathematics. (3) Prerequisite(s): MATH 4228 or MATH 5228, or permission of the department. A preparatory course for Actuarial Exam STAM. It covers severity models, frequency models, aggregarte models, coverage modifications, risk

measures, construction and selection of parametric models, credibility, insurance and reinsurance coverages, pricing and reserving for short-term insurance coverages.

STAT 7027. Topics in Statistics. (3) Prerequisite(s): Permission of department. Topics of current interest in statistics and/or applied statistics. *May be repeated for credit with permission of department.*

STAT 7122. Advanced Statistics I. (3) Prerequisite(s): MATH 7143 and STAT 5127 or permission of department. A survey of frequently used statistical techniques selected from: estimation theory and hypothesis testing, parametric goodness-of-fit criterion and tests for independence, measures of association, regression techniques, multi-sample inferential techniques, Bayes and minimax estimation, admissibility, minimax property.

STAT 7123. Advanced Statistics II. (3) Prerequisite(s): STAT 7122 or permission of department. Hypothesis testing, Neyman-Pearson Lemma, UMP tests, UMP unbiased tests, monotone likelihood ratio families of distributions, UMP invariant tests. Confidence bounds and regions, uniformly most accurate bounds, regression models, least squares estimates, normal equations, Gauss-Markov theorem. Large sample behavior of methods of moments estimates, maximum likelihood estimates, likelihood ratio tests, Chi-square tests, approximate confidence regions for large samples.

STAT 7124. Sampling Theory. (3) Prerequisite(s): STAT 5126 or permission of department. Methods and theory of survey sampling: simple, systematic, stratified, cluster multistage and specialized sampling schemes and the problems of their implementation and analysis.

STAT 7127. Linear Statistical Models. (3) Prerequisite(s): MATH 2164 and MATH 3123, or permission of department. A selection of topics from the following list: distribution and quadratic forms, regression, dummy variables, models not of full rank, the two-way crossed classification, time series.

STAT 7133. Multivariate Analysis. (3) Prerequisite(s): STAT 5126 and STAT 5127, or permission of department. Multivariate distributions. Inference for the multivariate normal model. Further topics from the following: principal components, factor analysis, multidimensional scaling, canonical correlation, discriminant analysis, cluster analysis, multivariate linear models, special topics.

STAT 7135. Statistical Computation. (3) Cross-listed Course(s): STAT 8135. Prerequisite(s): STAT 5126, STAT 5127, or permission of the department. A survey of modern methods of computational statistics used for both theoretical research and practical applications, including resampling methods, Markov chain Monte Carlo simulations, numerical optimization, parallel computation, etc. Statistical computational methodology is first presented and then implemented in the R software. Each method is illustrated by using either real application or simulated data sets as examples. Students learn how to conduct simulation and real data analysis, how to make efficient codes in R for their research, and how to apply each method in practice.

STAT 7137. Survival Analysis. (3) Cross-listed Course(s): STAT 8137. Prerequisite(s): STAT 5126 and STAT 5127, or permission of department. Introduction to statistical models, methods, and theories in the analysis of event history data. Topics include: failure time data and censoring, competing risks and multistage models, one-sample nonparametric estimation, k-sample hypothesis tests, the likelihood constructions for failure time data, and semi-parametric models including the Cox proportional hazards model and Aalen's additive hazards model. Also examines some graphical diagnosis methods and goodness-of-fit tests, as well as counting processes and martingales to study the theoretical properties of various estimators and hypothesis tests. Statistical software in R is used for data analysis to demonstrate the methods.

STAT 7139. Time Series Analysis. (3) Cross-listed Course(s): STAT 8139. Prerequisite(s): STAT 7127, STAT 8127, or permission of department. Provides an extensive survey of the theory, methods, and applications of time series analysis. Topics include: stationary and non-stationary models, time domain and frequency domain methods, models for estimation and inference in time series, etc.

STAT 7490. Industrial Internship. (0 to 6) Prerequisite(s): Completion of 6 credit hours of MATH/STAT/OPRS graduate courses and permission of department. Full- or part-time academic year or summer internship in mathematics and/or statistics complementary to the student's major course of study and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by the department's Graduate Program Director. Requires a mid-term report and a final report to be graded by the supervising faculty. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit up to 6 credit hours. Credit hours gained from the internship may not be counted toward the courses leading to advancement to candidacy.*

STAT 7891. Independent Study in Statistics. (1 to 3) Prerequisite(s): Permission of department. Faculty-directed independent study of topics not provided by other course offerings and/or to examine, extend, and enrich extant knowledge in statistics through supervised individual study. *May be repeated for credit with change of topic.*

STAT 7892. Directed Project in Statistics. (1 to 3) Prerequisite(s): Permission of department. The directed independent project may be original work, work of an expository nature, or the mathematical/statistical formulation and solution of a particular problem of statistical significance. The project may also involve a specific application of techniques identified in the literature or studied in other courses. The project must be defended in an oral presentation. *May be repeated for credit up to 6 credit hours.*

STAT 8027. Topics in Statistics. (3) Prerequisite(s): Permission of department. Topics of current interest in statistics and/or applied statistics. *May be repeated for credit with permission of department.*

STAT 8122. Advanced Statistics I. (3) Prerequisite(s): MATH 8143 and STAT 5127, or permission of department. A survey of frequently used statistical techniques selected from: estimation theory and hypothesis testing, parametric goodness-of-fit criterion and tests for independence, measures of association, regression techniques, multi-sample inferential techniques, Bayes and minimax estimation, admissibility, and minimax property.

STAT 8123. Advanced Statistics II. (3) Prerequisite(s): STAT 8122 or permission of department. Hypothesis testing, Neyman-Pearson Lemma, UMP tests, UMP unbiased tests, monotone likelihood ratio families of distributions, UMP invariant tests. Confidence bounds and regions, uniformly most accurate bounds, regression models, least squares estimates, normal equations, Gauss-Markov theorem. Large sample behavior of methods of moments estimates, maximum likelihood estimates, likelihood ratio tests, Chi-square tests, approximate confidence regions for large samples.

STAT 8124. Sampling Theory. (3) Prerequisite(s): STAT 5126 or permission of department. Methods and theory of survey sampling: simple, systematic, stratified, cluster multistage and specialized sampling schemes and the problems of their implementation and analysis.

STAT 8127. Linear Statistical Models. (3) Prerequisite(s): MATH 2164 and MATH 3123, or permission of department. A selection of topics from the following list: distribution and quadratic forms, regression, dummy variables, models not of full rank, the two-way crossed classification, and time series.

STAT 8133. Multivariate Analysis. (3) Prerequisite(s): STAT 5126 and STAT 5127, or permission of department. Multivariate distributions. Inference for the multivariate normal model. Further topics from the following: principal components, factor analysis, multidimensional scaling, canonical correlation, discriminant analysis, cluster analysis, multivariate linear models, and other special topics.

STAT 8135. Statistical Computation. (3) Cross-listed Course(s): STAT 7135. A survey of modern methods of computational statistics used for both theoretical research and practical applications, including resampling methods, Markov chain Monte Carlo simulations, numerical optimization, parallel computation, etc. Statistical computational methodology is first presented and then implemented in the R software. Each method is illustrated by using either real application or simulated data sets as examples. Students learn how to conduct simulation and real data analysis, how to make efficient codes in R for their research, and how to apply each method in practice.

STAT 8137. Survival Analysis. (3) Cross-listed Course(s): STAT 7137. Prerequisite(s): STAT 5126 and STAT 5127, or permission of department. Introduction to statistical models, methods, and theories in the analysis of event history data. Topics include: failure time data and censoring, competing risks and multistage models, one-sample nonparametric estimation, k-sample hypothesis tests, the likelihood constructions for failure time data, and semi-parametric models including the Cox proportional hazards model and Aalen's additive hazards model. Also examines some graphical diagnosis methods and goodness-of-fit tests, as well as counting processes and martingales to study the theoretical properties of various estimators and hypothesis tests. Statistical software in R is used for data analysis to demonstrate the methods.

STAT 8139. Time Series Analysis. (3) Cross-listed Course(s): STAT 7139. Prerequisite(s): STAT 7127, STAT 8127, or permission of department. Provides an extensive survey of the theory, methods, and applications of time series analysis. Topics include: stationary and non-stationary models, time domain and frequency domain methods, models for estimation and inference in time series, etc.

STAT 8490. Industrial Internship. (0 to 6) Prerequisite(s): Completion of 6 credit hours of MATH/STAT/OPRS graduate courses and permission of department. Full- or part-time academic year or summer internship in mathematics and/or statistics complementary to the student's major course of study and designed to allow theoretical and course-based practical learning to be applied in a supervised industrial experience. Each student's program must be approved by the department's Graduate Program Director. Requires a mid-term report and a final report to be graded by the supervising faculty. *Graded on a Pass/Unsatisfactory basis. May be repeated for credit up to 6 credit hours. Credit hours gained from the internship may not be counted toward the courses leading to advancement to candidacy.*

STAT 8891. Independent Study in Statistics. (1 to 3) Prerequisite(s): Permission of department. Faculty-directed independent study of topics not provided by other course

offerings and/or to examine, extend, and enrich extant knowledge in statistics through supervised individual study. *May be repeated for credit with change of topic.*

STAT 8892. Directed Project in Statistics. (1 to 3) Prerequisite(s): Permission of department. The directed independent project may be original work, work of an expository nature, or the mathematical/statistical formulation and solution of a particular problem of statistical significance. The project may also involve a specific application of techniques identified in the literature or studied in other courses. The project must be defended in an oral presentation. *May be repeated for credit up to 9 credit hours.*

Teaching English as a Second Language (TESL)

TESL 5103. Methods in Teaching English as a Second Language. (3) Cross-listed Course(s): EDCI 8183. For current and future teachers of English as a Second Language (ESL) to master a variety of approaches, methods and techniques of teaching ESL and other competencies prescribed by the state of North Carolina.

TESL 5104. Authentic Assessment. (3) For current and future teachers of English as a Second Language (ESL) to develop multiple criteria assessment models as TESL diagnosticians and to master other competencies prescribed by the state of North Carolina. (*Spring*)

TESL 5204. Inclusive Classrooms for Immigrant Students. (3) Cross-listed Course(s): TESL 4204. An introduction to the general issues related to the teaching of English Language Learners (ELLs) in diverse classroom and school contexts. Topics include: understanding current demographics and immigration trends, second language acquisition and the development of academic English, and modifying course content to meet the needs of ELLs. Examines issues of power, race, class, privilege, gender, and other factors that impede the educational success of diverse students-specifically English language learners (ELLs) in today's public schools.

TESL 5205. Second Language Acquisition and Linguistics in K-12 Schools. (3) Cross-listed Course(s): TESL 4205. An examination of concepts, theories, research, and practice related to the language acquisition and literacy development of English Language Learners in U.S. schools. Attention is paid to the physiological, social and psychological variables that influence the academic success of immigrant children and the challenges associated with first language literacy, second language literacy, and second language development in K-12 settings.

TESL 6000. Topics in Teaching English as a Second Language. (1 to 6) May include classroom and/or clinical experiences in the content area. *May be repeated for credit with permission of department.*

TESL 6204. Multicultural Education. (3) Assists teachers and other school personnel in the development of skills in multicultural curriculum, design and delivery. Examines issues of power, race, class, and privilege that affect the educational success of English Language Learners and other diverse student populations in today's public schools. Addresses the need to develop instructional practices that infuse critical multicultural education into the curriculum.

TESL 6206. Globalization, Communities, and Schools. (3) Cross-listed Course(s): EDCI 8206. An examination of the intersection of globalization and education with specific attention to the experiences of children of immigration in North Carolina K-12 communities and the contemporary phenomenon of transnationalism. Implications for the best K-12 educational practice are emphasized. This course does not carry a fieldwork requirement.

TESL 6470. Internship in Teaching English as a Second Language. (3 to 6) Prerequisite(s): Completion of all education coursework required for the "A" license, background requirements, an application for the course by established deadline, and approval of the department. Student teaching is a planned sequence of experiences in the student's area of specialization conducted in an approved school setting under the supervision and coordination of a university supervisor and a clinical educator. During student teaching, the student must demonstrate the competencies identified for their specific teaching field in an appropriate grade level setting. The student is assigned 15 weeks in a school setting. Includes seminars. Participating students pay a course registration fee for edTPA portfolio assessment. *Graded on a Pass/Unsatisfactory basis.*

TESL 6476. Advanced Pedagogy in Teaching English as a Second Language. (3) Cross-listed Course(s): FLED 6200. Prerequisite(s): Permission of the department. A variety of topics will be addressed in order to prepare experienced second language teachers to be critical thinkers, second language researchers, and instructional and program leaders. Exemplar topics include theories of second language acquisition, the history and trends of second language instructional methods, curriculum design, research-based practices, multicultural education, community partnerships, and mentoring of beginning teachers.

TESL 6691. Seminar in Professional Development. (3) Seminar focused on self-direction and professional development of English as Second Language Specialists

(ESL), with an increasing emphasis on becoming instructional leaders, as students plan to meet their own learning needs in instructional expertise; expand their awareness of the role of the ESL specialist; plan their program; use technology in presentations; and develop their Master's Thesis, Master's Research Project or Comprehensive Portfolio. The goal of the course is to help the student demonstrate through a culminating teaching portfolio that the student has obtained the knowledge, skills and dispositions of a master teacher.

TESL 6800. Individual Study in Teaching English as a Second Language. (1 to 6) Prerequisite(s): Permission of the student's advisor. Independent study under the supervision of an appropriate faculty member. *May be repeated for credit.*

Translating and Translation Studies (TRAN)

TRAN 5050. Topics in Translation Practica. (3) Selected topics in Translating and Translation Studies. Course may include practice in translating a variety of languages. *May be repeated at UNC Charlotte for credit with change of topic. May be repeated once for Study Abroad credit with change of topic.*

TRAN 5402. Practicum in Translating I - French. (3) Cross-listed Course(s): TRAN 4402. Provides guided practical experience in translating from French to American English, through work with a variety of source texts. Students present their translations to the class.

TRAN 5403. Practicum in Translating II - French. (3) Cross-listed Course(s): TRAN 4403. Prerequisite(s): TRAN 5402. Provides guided practical experience in translating from French to American English, through work with one genre of source texts. Students present their translations to the class.

TRAN 5404. Practicum in Translating III - French. (3) Cross-listed Course(s): TRAN 4404. Prerequisite(s): TRAN 5403. Provides individualized practical experience in translating from French to American English. Students present their translations to the class.

TRAN 5412. Practicum in Translating I - German. (3) Cross-listed Course(s): TRAN 4412. Provides guided practical experience in translating from German to American English, through work with a variety of source texts. Students present their translations to the class.

TRAN 5413. Practicum in Translating II - German. (3) Cross-listed Course(s): TRAN 4413. Prerequisite(s): TRAN 5412. Provides guided practical experience in translating from German to American English, through work with one genre of source texts. Students present their translations to the class.

TRAN 5414. Practicum in Translating III - German. (3) Cross-listed Course(s): TRAN 4414. Prerequisite(s): TRAN 5413. Provides individualized practical experience in translating from German to American English. Students present their translations to the class.

TRAN 5422. Practicum in Translating I - Japanese. (3) Cross-listed Course(s): TRAN 4422. Provides guided practical experience in translating from Japanese to American English, through work with a variety of source texts. Students present their translations to the class.

TRAN 5423. Practicum in Translating II - Japanese. (3) Cross-listed Course(s): TRAN 4423. Prerequisite(s): TRAN 5422. Provides guided practical experience in translating from Japanese to American English, through work with one genre of source texts. Students present their translations to the class.

TRAN 5424. Practicum in Translating III - Japanese. (3) Cross-listed Course(s): TRAN 4424. Prerequisite(s): TRAN 5423. Provides individualized practical experience in translating from Japanese to American English. Students present their translations to the class.

TRAN 5432. Practicum in Translating I - Russian. (3) Cross-listed Course(s): TRAN 4432. Provides guided practical experience in translating from Russian to American English, through work with a variety of source texts. Students present their translations to the class.

TRAN 5433. Practicum in Translating II - Russian. (3) Cross-listed Course(s): TRAN 4433. Prerequisite(s): TRAN 5432. Provides guided practical experience in translating from Russian to American English, through work with one genre of source texts. Students present their translations to the class.

TRAN 5434. Practicum in Translating III - Russian. (3) Cross-listed Course(s): TRAN 4434. Prerequisite(s): TRAN 5433. Provides individualized practical experience in translating from Russian to American English. Students present their translations to the class.

TRAN 6000. Special Topics in Translation Studies. (3) Selected topics in Translating and Translation Studies (e.g., continued study of theories of translation, translation of a literary genre such as prose fiction, drama or poetry, translation of historical, political or social documents, or interpretation). *May be repeated for credit with change of topic.*

TRAN 6472. Workshop on Non-Literary Topics I (Business, Legal, Governmental). (3) Theory-based workshop practicum dealing with the English↔Spanish translation of authentic business, legal, and/or governmental documents. Emphasis may center on any one of these types of discourse or any combination thereof. *May be repeated for credit with change of topic.*

TRAN 6474. Workshop on Non-Literary Topics II (Medical and Technical). (3) Theory-based workshop practicum dealing with the English↔Spanish translation of authentic medical, technical, and/or scientific documents. Emphasis may center on any one of these types of discourse or any combination thereof. *May be repeated for credit with change of topic.*

TRAN 6476. Workshop on Literary and Cultural Topics. (3) Theory-based workshop practicum dealing with the English↔Spanish translation of literary and/or cultural texts. Emphasis may center on one or both of these types of discourse. *May be repeated for credit with change of topic.*

TRAN 6480. Translation Internship. (1 to 6) On-site work in translating texts or interpreting. Site and workload is determined in consultation with employer and one faculty internship advisor. Translation Internship provides practical and professional training experience under conditions that cannot be recreated in the classroom. The internship course provides Translation Studies/Interpreting graduate students with an opportunity to earn credit for professional, non-classroom experiences related to their area of interest (e.g., legal, medical, scientific, technical, diplomatic, commercial, community). Students gain hands-on translation/interpreting practice and acquire valuable professional and communication skills in the workplace.

TRAN 6481. Translation Cooperative Education. (1 to 3) On-site work in translating texts or interpreting, English↔Spanish. Site, workload and remuneration to be determined in consultation with employer and one faculty co-op advisor. Provides practical and professional training experience under conditions that the University cannot duplicate.

TRAN 6601. History, Theory, and Method of Translation. (3) Theories of translation from Horace and Cicero to the present. Provides a historical, theoretical, and sociological framework for the translation enterprise. Emphases may differ from year to year. *May be repeated for credit with change of topic.*

TRAN 6602. Linguistics for Translators. (3) The study of translation issues through the lens of linguistic theory, namely semantic, pragmatic, and psycholinguistic theories.

TRAN 6603. Computer-Assisted Translating. (3) Focus on discourse and textual typologies (representative kinds of writing and kinds of documents and texts) that the practicing translator may encounter. Development of reading, recognition, and reproduction skills. Strategies for lexical development and terminology management. *May be repeated for credit with change of topic.*

TRAN 6604. Translation Project Management. (3) Provides a hands-on introduction to traditional project management and its application to translations and localization projects (cultural adaptation), enhancing one's understanding of the language industry while providing preparation for a successful transition to the job market.

TRAN 6901. Advanced Project in English↔Spanish Translating. (1 to 3) Selected topics in English↔Spanish Translating and Translation Studies (e.g., continued study of theories of translation, translation of a literary genre such as prose fiction, drama or poetry, translation of historical, political or social documents, or interpretation). *May be repeated for credit with change of topic.*

TRAN 6902. Thesis. (1 to 6) Appropriate research and written exposition of that research, or substantial English↔Spanish translation project with critical introduction and commentary. The proposed thesis work, as well as the final product, will be approved by a committee of three faculty appropriate to the topic, appointed by the Department Chair after consultation with the student and the Graduate Program Director, on the basis of a written proposal from the student. (A statement of recommendations and requirements for form and procedure is available in the Department of Languages and Culture Studies.) *May be repeated for credit up to 6 credits.*

Women's and Gender Studies (WGST)

WGST 5050. Topics in Women's Studies. (1 to 3) Prerequisite(s): Varies with change of topic. Special topics in Women's Studies. *May be repeated for credit with change of topic.*

WGST 5131. Culture, Pregnancy, and Birth. (3) Cross-listed Course(s): ANTH 5131. Explores how culture shapes the experience and practice of pregnancy and birth. Some of the topics explored include the birthing experience, midwifery, infertility, new reproductive technologies, and surrogate motherhood.

WGST 5151. Women, Biology, and Health. (3) An understanding of the structure and functions of women's bodies and examines the social, economic, environmental,

behavioral, and political factors associated with women's health.

WGST 5152. Ecological Feminism. (3) Examines the cultural conditions that make possible the marginalization of both women and nature, the connections between feminism and environmentalism, and the relation between the norms and practices that inform developmental and environmental policies.

WGST 5160. Race, Sexuality, and the Body. (3) Examines how biological, historical, and cultural interpretations of race and gender influenced and characterized definitions of sexuality and body image among persons of color.

WGST 5170. Queer Theory. (3) Introduction to key issues in queer theory, a field of studies that questions and redefines the identity politics of early lesbian and gay studies by investigating the socially constructed nature of identity and sexuality and critiquing normalizing ways of knowing and being.

WGST 5180. Introduction to Gender, Sexuality, and Women's Studies. (3) Understanding the various methods that serve as the foundation for the Gender, Sexuality, and Women's Studies discipline. Given that this discipline is in many ways interdisciplinary, how we conceive of methods is markedly distinct. As such, the methods that serve as foundational for this course concern particular lenses that could (or ought to) be applied to any field of study and yet are also central to Gender, Sexuality, and Women's Studies. Not only does this course seek to understand the experiences of race, gender, sexuality, but it will also seek to expand a framework to account for a multiplicity of systems of oppression, such as ableism, xenophobia, and settler colonialism. Also, this course complicates understandings of these various systems, of the ways in which they compound and intersect. Finally, how we ought to do the work of Gender, Sexuality, and Women's Studies is considered. For instance, how are we to be accountable to the communities we seek to engage with textually? In what ways ought we to develop our political and philosophical commitments when doing this work?

WGST 5190. Indigenous Feminisms. (3) Cross-listed Course(s): WGST 4190. Focuses on Indigenous feminist writings that both aim toward a constructive project of maintaining and respecting Indigenous ways of life, and that seek to address the detrimental consequences of U.S. and Canadian settler colonialism. This begins with a theoretical analysis of key concepts such as settler colonialism, Indigeneity, gender, and institutional racism. Using these key concepts, present-day colonial formations located through state-sponsored child and family welfare services, patterns of incarceration, high rates of sexual violence, and the displacement of Indigenous peoples from their traditional lands are examined. Lastly, state-based efforts to address the needs of Indigenous communities, and collective strategies of resistance practiced by Indigenous women are explored.

WGST 6050. Topics in Women's Studies. (1 to 3) Prerequisite(s): Varies with change of topic. Special topics in Women's Studies. *May be repeated for credit with change of topic.*

WGST 6601. Theoretical Approaches to Sexuality. (3) An interdisciplinary examination of the history of sexuality and contemporary theories of sexuality and the body. Topics include: historical aspects of sexuality, representations of sexuality, politics of sexuality, critiques of psychoanalytic approaches to sexuality, feminist engagement with biological constructions of sexuality, and queer theory.

WGST 6602. Theoretical Approaches to Gender. (3) Cross-listed Course(s): ANTH 6612. An interdisciplinary examination of the core theories about the role of gender in identity formation and social organization. Topics include: the feminist critique of biological essentialism; gender as a continuum; the social construction of gender; gender performativity; historical changes in gender; masculinity studies; the intersection of race, class and gender; and the economics of gender.

WGST 6603. Language, Gender and Power. (3) An examination of the ways language constructs sexual difference and power relations among groups. Topics include: the role of language in structuring individual identity and human relations; how that process informs the nature of social institutions; and the control language exercises over human society, from the private to the public domain.

WGST 6627. Feminist Theory and its Applications. (3) An examination of selected works in feminist thought across the disciplines.

WGST 6800. Directed Reading/Research. (3) Prerequisite(s): Prior written permission of instructor and Women's and Gender Studies Director. Independent investigation of a problem or a topic in Gender, Sexuality or Women's Studies, culminating in a research paper or a final report. Student must provide a written plan of work before registering for the course. *May be repeated for credit.*

Faculty Directory

FACULTY

(Note: The year in parentheses represents the year of appointment)

Gaber, Sharon L. (2020); *Chancellor; Professor, Department of Geography and Earth Sciences*; A.B., Occidental College; MPL, University of Southern California; Ph.D., Cornell University

Lorden, Joan F. (2003); *Provost and Vice Chancellor for Academic Affairs; Professor, Department of Psychological Science*; B.A., City College of New York; M.S., Yale University; Ph.D., Yale University

Gray, Lee E. (1990); *Interim Senior Associate Provost, Professor, School of Architecture*; B.A., Iowa State University; M.Arch., University of Virginia; Ph.D., Cornell University

Abel, Willie M. (2013); *Associate Professor, School of Nursing;* B.S.N., University of North Carolina at Charlotte; M.S.N., University of North Carolina at Greensboro; Ph.D., University of North Carolina at Greensboro

Abrams, Lyndon P. (2001); *Associate Professor, Department of Counseling;* B.S., Charleston Southern University; M.Ed., Clemson University; Ph.D., Texas A&M University-Commerce

Adams, L. Dean (2013); *Associate Dean of Performing Arts Services, College of Arts + Architecture; Professor, Department of Theatre*; B.A., Tufts University; M.A., University of Maryland; M.F.A., Florida State University

Afonin, Kirill (2015); *Professor, Department of Chemistry;* M.S., Saint Petersburg State Polytechnic University; Ph.D., Bowling Green State University

Aggarwal, Ishwar D. (2011); *Research Professor, Department of Physics and Optical Science;* M.C.E., The Catholic University of America; Ph.D., The Catholic University of America

Agosta, Rebecca (2013); *Lecturer, Department of Writing, Rhetoric, and Digital Studies;* B.S.Ed., Appalachian State University; M.A., University of North Carolina at Charlotte

Ahmed, Dewan (2013); *Teaching Assistant Professor, Department of Computer Science;* B.S., Bangladesh University of Engineering and Technology; M.S., Bangladesh University of Engineering and Technology; Ph.D., University of Ottawa

Ajazi, Elizabeth (2014); *Lecturer, Department of Mathematics and Statistics;* B.S., University of North Carolina at Charlotte; M.S., University of North Carolina at Charlotte

Akella, Srinivas (2009); *Professor, Department of Computer Science;* B.Tech., Indian Institute of Technology, India; M.S., Carnegie Mellon University; Ph.D., Carnegie Mellon University

Aktas, Yildirim M. (1989); *Associate Professor, Department of Physics and Optical Science;* B.S., Middle East Technical University; Ph.D., University of Missouri at Columbia

Aliaga-Buchenau, Ana-Isabel (2002); *Professor, Department of Languages and Culture Studies;* B.A., Georg-August Universitat Gottingen; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill

Allan, Craig J. (1992); *Professor, Department of Geography and Earth Sciences;* B.Sc., University of Manitoba; M.Sc., Trent University; Ph.D., York University

Allen, Tyler (2022); *Assistant Professor, Department of Computer Science;* B.S., Western Carolina University; M.S., Clemson University; Ph.D., Clemson University

Al-Shaer, Ehab (2009); *Professor, Department of Software and Information Systems;* B.S., King Fahad University; M.S., Northeastern University; Ph.D., Old Dominion University

Alston, Daniel (2016); *Associate Professor, Department of Reading and Elementary Education;* B.S., University of South Carolina; M.A.T., University of South Carolina; Ph.D., Clemson University

Alterowitz, Gretchen (2009); *Chair and Professor, Department of Dance;* B.A., University of Montana; M.F.A., University of Iowa

Alvis, Sid (2022); *Professor, Office of Student Development and Success, The William States Lee College of Engineering;* B.S., Virginia Military Institute; M.B.A., Northern Illinois University

Amato, Louis (Ted) H. (1980); *Professor, Department of Economics;* A.B., Lenoir-Rhyne College; M.A., University of North Carolina at Greensboro; Ph.D., University of South Carolina

Amburgey, James E. (2005); *Associate Professor, Department of Civil and Environmental Engineering;* B.S.C.E., University of North Carolina at Charlotte; M.S., University of North Carolina at Charlotte; Ph.D., Georgia Institute of Technology

Amengonu, Yawo H. (2015); *Visiting Lecturer, Department of Electrical and Computer Engineering;* B.S.E.E., University of North Carolina at Charlotte; M.S.E.E., University of North Carolina at Charlotte

Amidei, Allison (2015); *Associate Professor, Department of Theatre;* B.A., Knox College; M.F.A., Carnegie Mellon University

Amin, Takiyah N. (2011); *Assistant Professor, Department of Dance;* B.A., State University of New York at Buffalo; M.F.A., Virginia Polytechnic Institute and State University; Ph.D., Temple University

Amoui, Shahram (2016); *Lecturer, Department of Dance;* B.M., Berklee College of Music

Anderson, Brittany (2020); *Assistant Professor, Department of Middle, Secondary, and K-12 Education;* B.S.Ed., Baylor University; M.Ed., University of North Texas; Ph.D., University of Georgia

Anderson, Heather T. (2007); *Lecturer, School of Nursing;* A.A., Gardner-Webb University; B.S.N., Gardner-Webb University; M.S.N., Gardner-Webb University

Anderson, Kelly (2000); *Professor, Department of Special Education and Child Development;* B.S., Drake University; M.S., Drake University; Ph.D., University of North Carolina at Greensboro

Anderson, Nadia (2016); *Associate Professor, School of Architecture;* B.Arch., Yale University; M.Arch., University of Pennsylvania

Andrés, Benny J. (2007); *Associate Professor, Department of History;* B.A., San Diego State University; M.A., University of New Mexico; Ph.D., University of New Mexico

Arafa, Ahmed (2019); *Assistant Professor, Department of Electrical and Computer Engineering;* B.S., Alexandria University; M.S., University of Maryland, College Park; Ph.D., University of Maryland, College Park

Arif, Ahmed A. (2007); *Professor, Department of Public Health Sciences;* B.S., Sindh Medical College; M.S., Western Kentucky University; Ph.D., University of Texas at Houston

Armour, Jake (2005); *Lecturer, Department of Geography and Earth Sciences;* B.S., University of New Mexico; M.S., University of New Mexico

Armstrong, Laura M. (2013); *Associate Professor, Department of Psychological Science;* B.S., Brown University; M.S., Pennsylvania State University; Ph.D., Pennsylvania State University

Armstrong, Melinda (2020); *Lecturer, School of Nursing;* B.A., University of North Carolina at Charlotte; B.S.N., University of North Carolina at Charlotte; M.S.N., University of North Carolina at Charlotte

Arnold, Denis G. (2008); *Surtman Distinguished Scholar in Business Ethics; and Professor, Department of Management;* B.S., Lewis and Clark College; M.A., University of Minnesota; Ph.D., University of Minnesota

Arreola, Brian K. (2009); *Professor, Department of Music;* B.M., St. Olaf College; M.M., Indiana University; Ph.D., Indiana University

Arrigo, Bruce A. (2001); *Professor, Department of Criminal Justice and Criminology;* B.A., Saint Joseph's University; M.A., Duquesne University; Ph.D., Pennsylvania State University

Arthur, Susan T. (2006); *Associate Professor, Department of Applied Physiology, Health, and Clinical Sciences;* B.S., University of Toledo, Ohio; M.S., University of Toledo, Ohio; Ph.D., University of Toledo, Ohio

Asala, Kathryn (2007); *Teaching Professor, Department of Chemistry;* B.S, Truman State University; Ph.D., Miami University

Astratov, Vasily (2002); *Professor, Department of Physics and Optical Science;* Dipl., St. Petersburg State University; Ph.D., Ioffe Physical-Technical Institute

Athanasopoulou, Anna (2013); *Lecturer, Department of Mathematics and Statistics;* B.S., Aristotle University of Thessaloniki; M.A., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Atkinson, Mary L. (2013); *Associate Professor, Department of Political Science and Public Administration;* B.A., Guilford College; M.A., The American University; Ph.D., University of North Carolina at Chapel Hill

Auerbach, Bruce (2002); *Professor, Department of Theatre;* B.A., Auburn University; M.F.A., University of Illinois at Urbana-Champaign

Auten, Anna E. (2017); *Assistant Professor and Health and Human Services Librarian, J. Murrey Atkins Library;* B.S., Tulane University; M.A., University of Florida; M.L.I.S., Florida State University

Avila, JuliAnna (2010); *Associate Professor, Department of English;* B.A., University of Redlands; M.A.Ed., University of California, Berkeley; Ph.D., University of California, Berkeley

Avrin, Joel D. (1984); *Professor, Department of Mathematics and Statistics;* A.B., University of California, Berkeley; M.A., University of California, Berkeley; Ph.D., University of California, Berkeley

Azarbayjani, Mona (2010); *Associate Professor, Department of Art and Art History;* B.S., Iran University of Science and Technology; M.Arch, Iran University of Science and Technology; Ph.D., University of Illinois at Campaign

Baez-Rivera, Yamilka I. (2014); *Teaching Assistant Professor, Department of Engineering Technology and Construction Management;* B.S.E.E., University of Puerto Rico; M.S.E.E., University of Puerto Rico; Ph.D., Mississippi State University

Bahamon, Julio C. (2016); *Teaching Assistant Professor, Department of Computer Science;* B.S., Texas A&M University; M.S., Florida State University; Ph.D., North Carolina State University

Bai, Linquan (2019); *Assistant Professor, Department of Systems Engineering and Engineering Management;* B.S., Tianjin University, China; M.S.E.E., Tianjin University, China; Ph.D., University of Tennessee, Knoxville

Baker, Debra D. (2003); *Lecturer, Department of Communication Studies;* B.A., University of North Carolina at Charlotte; M.A., University of North Carolina at Greensboro

Balcos, E. E. (2005); *Professor, Department of Dance;* B.A., The Colorado College; M.F.A., University of Iowa

Balmer, Jeffrey D. (2006); *Associate Professor, School of Architecture;* B.E.S., University of Waterloo; B.Arch., University of Waterloo; M.Arch, Iowa State University

Balog, Valerie G. (2005); *Clinical Assistant Professor, Department of Counseling;* B.S., John Carroll University; M.A., John Carroll University; Ph.D., Kent State University

Banerjee, Enika (2018); *Lecturer, Department of Languages and Culture Studies;* B.A., Sophia University, Japan; M.A., University of London, England

Banks, Erin R. (2018); *Assistant Dean for Undergraduate Research, Office of Undergraduate Education; Clinical Assistant Professor, Department of Psychological Science*; B.S., Florida A&M University; M.S., Florida A&M University; Ph.D., North Carolina State University

Banks, George C. (2015); *Chair and Professor, Department of Management;* B.A., College of William & Mary; M.A., University of New Haven; Ph.D., Virginia Commonwealth University

Baran, Audrey I. (2020); *Visiting Assistant Professor, Department of Dance;* B.A., University of North Carolina at Charlotte; M.F.A., Hollins University

Barclay, Nicole (2016); *Assistant Professor, Department of Engineering Technology and Construction Management;* B.S., South Carolina State University; M.S., Clemson University; Ph.D., Clemson University

Barfield, Auguste (2022); *Chair and Professor, Department of Applied Physiology, Health, and Clinical Sciences*

Barnes, Meghan (2017); *Assistant Professor, Department of English;* B.A., University of North Carolina at Chapel Hill; M.A.T., University of North Carolina at Chapel Hill; Ph.D., University of Georgia

Barth, Thomas J. (2016); *Professor, Department of Political Science and Public Administration;* B.A., University of Notre Dame; M.A., The University of Chicago; Ph.D., Virginia Polytechnic Institute and State University

Barto, Jeffrey (1992); *Lecturer, Department of Applied Physiology, Health, and Clinical Sciences;* B.S., Slippery Rock University; M.Ed., University of Pittsburgh; Ph.D., University of Pittsburgh

Basinger, Erin (2016); *Associate Professor, Department of Communication Studies;* B.A., Samford University; M.A., University of Georgia; Ph.D., University of Illinois at Urbana-Champaign

Basu, Balaka (2013); *Associate Professor, Department of English;* B.A., Cornell University; Ph.D., City University of New York

Bates, Tonya C. (2010); *Lecturer, Department of Biological Sciences;* B.A., University of North Carolina at Charlotte; B.S., University of North Carolina at Charlotte; M.S., University of North Carolina at Charlotte

Batista, José M. (2003); *Associate Professor, Department of Languages and Culture Studies;* B.A., Manhattan College; M.A., University of Georgia; Ph.D., University of Georgia

Batista Pereira, Frederico (2016); *Assistant Professor, Department of Political Science and Public Administration;* B.A., Federal University of Minas Gerais, Brazil; M.A., Federal University of Minas Gerais, Brazil; Ph.D., Vanderbilt University

Bayer, Ashley (2017); *Lecturer, Office of School and Community Partnerships, Cato College of Education;* B.S., St. John Fisher College; M.S.Ed., St. Bonaventure University

Beach, Kristen D. (2014); *Associate Professor, Department of Child Development and Special Education;* B.A., University of California, Los Angeles; M.A., Loyola Maramount University; Ph.D., University of California, Riverside

Beaman, Jonathan M. (2014); *Lecturer, Department of Mechanical Engineering and Engineering Science;* B.S.M.E., University of North Carolina at Charlotte; M.S.M.E., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Beem, Randi E. (2018); *Assistant Professor and Instruction Librarian/Archivist, J. Murrey Atkins Library;* B.A., Saint Mary's College; M.L.S., Indiana University Bloomington

Beete, Deborah Ann D. (2018); *Lecturer, Department of Public Health Sciences;* B.A., Columbia College; M.Div., McCormick Theological Seminary; M.P.H., Columbia University

Beggs, Joyce M. (1989); *Associate Professor, Department of Management;* B.S., Concord College; M.A., Marshall University; M.B.A., West Virginia College of Graduate Studies; Ph.D., University of Tennessee

Bejger, Christopher M. (2015); *Associate Professor, Department of Chemistry;* B.S., University of Oregon; Ph.D., University of Texas at Austin

Benjamin, Michael (2020); *Teaching Assistant Professor, Department of Engineering Technology and Construction Management;* B.S., South Dakota State University; M.S., University of Cincinnati; M.S., University of Cincinnati; Ph.D., University of Cincinnati

Bennett, Jeanette M. (2012); *Associate Professor, Department of Psychological Science;* B.A., Gannon University; B.S., Gannon University; M.S., Pennsylvania State University; Ph.D., Pennsylvania State University

Beorkrem, Christopher J. (2005); *Associate Professor, School of Architecture;* B.Arch., Iowa State University; M.S., Columbia University

Berardinelli, Angela (2019); *Senior Lecturer, Department of Computer Science;* B.S., Ursinus College; M.S., University of North Texas; Ph.D., University of North Texas

Bergmann, Malena (2003); *Lecturer, Department of Art and Art History;* B.F.A., University of North Carolina at Greensboro; M.F.A., University of Florida

Berman, Elise (2012); *Associate Professor, Department of Anthropology;* B.A., Dartmouth College; M.A., The University of Chicago; Ph.D., The University of Chicago

Berry, Christopher A. (2020); *Assistant Professor, Department of Theatre;* B.F.A., North Carolina Agricultural and Technical State University; M.F.A., Brown University

Bess, Marcus (2013); *Assistant Professor and Instruction Librarian, J. Murrey Atkins Library;* B.A., University of North Carolina at Charlotte; M.S., North Carolina Central University

Biller, Justin B. (2018); *Lecturer, Department of Engineering Technology and Construction Management;* B.S.E.T., Old Dominion University; M.S., California Polytechnic State University

Billings, Stephen (2008); *Associate Professor, Department of Political Science and Public Administration;* B.A., Georgetown University; M.A., University of North Carolina at Chapel Hill; M.A., University of Colorado; Ph.D., University of Colorado

Binder, Amanda H. (2012); *Assistant Professor and Special Sciences and History Librarian, J. Murrey Atkins Library;* B.A., Bard College; M.S., University of Illinois at Urbana-Champaign

Binns, Ian (2011); *Associate Professor, Department of Reading and Elementary Education;* B.S., North Carolina State University; M.Ed., North Carolina State University; Ph.D., University of Virginia

Birdsong, Sarah (2016); *Visiting Lecturer, Department of Mathematics and Statistics;* B.S., Mars Hill College; M.S., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Bishop, Nancy (2016); *Lecturer, Department of Art and Art History;* B.F.A., Kansas City Art Institute; M.A., University of Kansas; Ph.D., University of Iowa

Bishwal, Jaya P. (2005); *Professor, Department of Mathematics and Statistics;* B.S., Sambalpur University; M.S., Sambalpur University; M.Phil., Sambalpur University; Ph.D., Sambalpur University

Bissière, Michèle (1990); *Chair and Professor, Department of Languages and Culture Studies;* M.A., University of Wisconsin at Madison; Ph.D., University of Wisconsin at Madison

Bjerregaard, Beth E. (1992); *Professor, Department of Criminal Justice and Criminology;* B.S., Kent State University; M.S., Kent State University; Ph.D., State University of New York at Albany

Black, Jason E. (2016); *Professor, Department of Communication Studies;* B.A., Florida State University; M.A., Wake Forest University; Ph.D., University of Maryland, College Park

Blair, Peter A. (2006); *Lecturer, Department of Writing, Rhetoric, and Digital Studies;* B.A., Saint Vincent College; M.A., Duquesne University; Ph.D., University of Iowa

Blanchard, Anita (2001); *Associate Professor, Department of Psychological Science;* B.S., University of North Carolina at Chapel Hill; M.S., University of North Carolina at Chapel Hill; M.A., Claremont Graduate University; Ph.D., Claremont Graduate University

Blandford, Cassandra L. (2015); *Lecturer, Department of Writing, Rhetoric, and Digital Studies;* B.A., Miami University; M.A., University of Louisville

Blat, Catherine (2005); *Assistant Dean for Student Experiences, The William States Lee College of Engineering;* B.S.E.E., University of North Carolina at Charlotte; M.S.E, University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Bledsoe, Jordan R. (2012); *Lecturer, Department of Languages and Culture Studies;* B.A., Brigham Young University; M.A., Brigham Young University

Blitvich, Pilar G. (2005); *Professor, Department of English;* B.A., University of Valencia; M.A., University of Valencia; Ph.D., University of Valencia

Boardman, Erika D. (2022); *Assistant Professor and Electronic Resources Management Librarian, J. Murrey Atkins Library;* B.A., University of North Carolina at Charlotte; M.L.I.S., University of North Carolina at Greensboro

Boaz, Danielle N. (2015); *Associate Professor, Department of Africana Studies;* J.D., University of Toledo; L.L.M., St. Thomas University; M.A., Florida International University; Ph.D., University of Miami

Bobyarchick, Andy R. (1983); *Associate Professor, Department of Geography and Earth Sciences;* B.S., Birmingham-Southern College; M.S., Virginia Polytechnic Institute and State University; Ph.D., State University of New York at Albany

Bochantin, Jamie E. (2014); *Associate Professor, Department of Communication Studies;* B.A., DePaul University; M.A., DePaul University; Ph.D., Texas A&M University

Boisvert, Daniel (2007); *Senior Lecturer, Department of Philosophy;* B.A., Providence College; B.A., University of Central Florida; M.A., University of Florida; Ph.D., University of Florida

Bonoffski, Tracy (2007); *Lecturer, Department of Applied Physiology, Health, and Clinical Sciences;* B.S., Cornell University; M.S., Wake Forest University

Boreman, Glenn D. (2011); *Chair and Professor, Department of Physics and Optical Science;* B.S., University of Rochester; M.S., University of Arizona; Ph.D., University of Arizona

Bottia, Martha C. (2011); *Research Assistant Professor, Department of Sociology;* B.A., University of Los Andes; M.A., University of Los Andes; M.A., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Bowen, James D. (1996); *Associate Professor, Department of Civil and Environmental Engineering;* B.A., Duke University; M.S., Vanderbilt University; Ph.D., Massachusetts Institute of Technology

Bowling, Jessamyn (2016); *Associate Professor, Department of Public Health Sciences;* B.A., University of North Carolina at Chapel Hill; M.P.H., University of Arizona; Ph.D., Indiana University Bloomington

Boyd, Alice Suzanne (2002); *Associate Professor, School of Social Work;* B.A., University of Virginia; M.S.W., Virginia Commonwealth University; Ph.D., Virginia Commonwealth University

Boyd, David G. (2018); *Assistant Professor, Department of Languages and Culture Studies;* B.A., University of California, Los Angeles; M.A., The University of Tokyo, Japan; M.A., Princeton University; Ph.D., Princeton University

Brais, Sayde (2013); *Lecturer, Department of Communication Studies;* B.A., University of North Carolina at Charlotte; M.A., University of North Carolina at Charlotte

Brandon, Jamie D. (2018); *Clinical Assistant Professor, School of Nursing;* B.S., Winston-Salem State University; M.S., Western Carolina University; D.N.P., Gardner-Webb University

Branton, Regina (2022); *Professor, Department of Political Science and Public Administration;* B.A., University of South Carolina; M.A., University of Wyoming; Ph.D., University of Arizona

Braxtan, Nicole (2016); *Assistant Professor, Department of Civil and Environmental Engineering;* B.S., Rutgers University; M.S., Princeton University; Ph.D., Lehigh University

Brian, William R. (2017); *Assistant Professor, Department of Mathematics and Statistics;* B.A., Baylor University; M.S., Tulane University; Ph.D., University of Oxford

Brintnall, Kent (2008); *Associate Professor, Department of Religious Studies;* B.A., Fort Hays State University; M.A., Pacific School of Religion; J.D., Northeastern University; Ph.D., Emory University

Brizendine, Anthony L. (2002); *Chair and Professor, Department of Engineering Technology and Construction Management;* B.S., Bluefield State College; M.S., Virginia Polytechnic Institute and State University; Ph.D., West Virginia University

Brodeur, David (2000); *Associate Professor, Department of Art and Art History;* B.S., Southern Connecticut State University; M.F.A., University of Wisconsin

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EMERITUS FACULTY

(Note: The year in parentheses represents the year of appointment)

Emeritus status is an honor and a mark of distinction granted to fully retired faculty members and senior administrative or academic officers whose service is characterized by high personal achievement and outstanding service to UNC Charlotte.Emeritus faculty members are granted several privileges, among them use of the University library and recreational facilities; a University email account; inclusion in the University catalog and campus directory; invitations to University Commencement and other events; opportunity to purchase tickets for University athletic and cultural events at faculty rates; receipt of University and alumni publications; and free campus parking.

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Reiter, Harold B. (1972); *Professor, Department of Mathematics and Statistics; B.S., Louisiana State University*; M.S., Clemson University; Ph.D., Clemson University

Revesz, Gyorgy E. (1991); *Professor Emeritus, Department of Computer Science;* B.S., Eötvös Loránd University, Hungary; Ph.D., Eötvös Loránd University, Hungary

Reynolds, Thomas L. (1982); *Associate Provost for Graduate Programs; Dean of the Graduate School; and Professor Emeritus, Department of Biological Sciences;* B.A., California State University; M.A., California State University; Ph.D., Ohio State University

Rickelman, Robert J. (1991); *Professor Emeritus, Department of Reading and Elementary Education;* B.A., Ohio University; M.Ed., Ohio University; Ph.D., University of Georgia

Ringwood, Amy (2004); *Associate Professor Emerita, Department of Biological Sciences;* B.A., Wake Forest University; Ph.D., University of Hawaii at Manoa

Risley, John M. (1988); *Professor Emeritus, Department of Chemistry;* B.S., Ball State University; Ph.D., Purdue University

Robbins, Stephanie S. (1981); *Professor Emerita, Department of Business Information Systems and Operations Management;* A.A., Lasell College; B.A., Emerson College; M.Ed., University of Memphis; Ph.D., University of Alabama; Ph.D., Louisiana State University

Robinson, Bryan E. (1977); *Professor Emeritus, Department of Counseling, Special Education, and Child Development;* B.A., East Carolina University; M.Ed., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Greensboro

Rose, Russell G. (1969); *Associate Professor Emeritus, Department of Languages and Culture Studies;* B.A., Wilmington College; M.A., University of Kentucky; Ph.D., University of Kentucky

Rothe, Franz (1989); *Associate Professor Emeritus, Department of Mathematics and Statistics;* B.A., Universitat Fridericiana, Germany; M.A., Eidgenossiche Technishe Hochschule, Switzerland; Ph.D., Universitat zu Tubingen, Germany

Rowland, Bobbie Haynes (1969); *Professor Emerita, Department of Counseling, Special Education, and Child Development;* A.B., University of North Carolina at Greensboro; M.S., University of North Carolina at Greensboro; Ph.D., University of North Carolina at Greensboro

Rubin, Beth A. (2002); *Professor Emerita, Department of Sociology;* B.A., State University of New York at New Paltz; M.A., Indiana University at Bloomington; Ph.D., Indiana University at Bloomington

Runnion, Carole E. (1989); *Librarian and Associate Professor Emerita, Atkins Library;* B.A., Catawba College; M.S.L.S., University of North Carolina at Chapel Hill

Russo, Benjamin (1984); *Professor Emeritus, Department of Economics;* B.A., State University of New York at Stony Brook; M.A., University of Iowa; Ph.D., University of Iowa

Saman, Paul Antonius (1963); *Professor Emeritus, Department of Languages and Culture Studies;* Ph.D., Charles University

Sandarg, Robert M. (1984); *Associate Professor Emeritus, Department of Languages and Culture Studies;* B.A., University of North Carolina at Chapel Hill; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill

Sanders, Lonnie Delores (1974); *Assistant Professor Emerita, School of Nursing;* B.S.N., Winston-Salem State University; M.Ed., University of North Carolina at Charlotte; M.N., University of South Carolina; Ph.D., University of South Carolina

Schell, Joseph F. (1964); *Professor Emeritus, Department of Computer Science;* B.S., University of Dayton; M.A., Indiana University; Ph.D., Indiana University

Schroeder, Richard G. (1991); *Professor Emeritus, Turner School of Accountancy;* B.Ed., Chicago Teachers College; M.B.A., Northwestern University; D.B.A.; B.A., Arizona State University

Schul, Norman W. (1967); *Professor Emeritus, Department of Geography and Earth Sciences;* B.A., Miami University; M.A., Miami University; Ph.D., Syracuse University

Schuster, Marilyn B. (1990); *Associate Professor Emerita, J. Murrey Atkins Library;* B.A., University of North Carolina at Charlotte; M.L.S., University of South Carolina

Sealey, Calvin W. (Bill) (1996); *Distinguished Professor Emeritus, Department of Finance;* B.A., University of North Carolina at Asheville; M.A., University of Georgia; Ph.D., University of Georgia

Shafer, Douglas S. (1978); *Professor Emeritus, Department of Mathematics and Statistics;* B.S., Carson-Newman College; M.S., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill

Shenk, Dena (1991); *Professor Emerita, Department of Anthropology;* B.A., State University of New York at Stony Brook; M.A., University of Massachusetts; Ph.D., University of Massachusetts

Sherlock, Barry G. (1997); *Professor Emeritus, Department of Engineering Technology and Construction Management;* B.S.E.E., University of Cape Town, South Africa; M.S.E.E., University of Cape Town, South Africa; Ph.D., Imperial College, University of London

Sherry, Stanley (Lee) A. (2007); *Associate Professor Emeritus, Department of Special Education and Child Development;* B.A., Temple University; M.Ed., Temple University; Ph.D., University of Florida

Shumaker, James D. (1972); *Professor Emeritus, Department of Philosophy;* A.B., Pfeiffer College; M.A., Florida State University; Ph.D., Florida State University

Siegfried Jr., William D. (1976); *Associate Professor Emeritus, Department of Psychology;* B.A., Trinity College; M.A., Long Island University; Ph.D., Ohio State University

Silverman, Gary S. (2012); *Professor Emeritus, Department of Public Health Sciences;* B.A., Claremont McKenna College; M.S., University of California, Berkeley; Ph.D., University of California, Los Angeles

Simono, Ronald Bernard (1967); *Professor Emeritus, Department of Psychology;* B.S., St. Norbert College; M.S., University of Wisconsin; Ph.D., University of Wisconsin

Simpson, Hoyle Mitchel (1982); *Associate Professor Emeritus, Department of Physics and Optical Science;* B.A., Pfeiffer College; Ph.D., Clemson University

Smith, William Alexander (1966); *Associate Professor Emeritus, Department of Electrical Engineering;* A.A., Charlotte College; B.S., Charlotte College; M.S., Clemson University; P.E.,

Smith Jr., Clarence E. (1970); *Professor Emeritus, Department of Educational Leadership;* B.A., University of North Carolina at Chapel Hill; M.A.T., University of North Carolina at Chapel Hill; Ed.D., University of North Carolina at Chapel Hill

Snyder, Robert D. (1975); *Dean Emeritus, The William States Lee College of Engineering; Professor Emeritus, Department of Engineering Science*; B.S.M.E., Indiana Institute of Technology; M.S.M.E., Clemson University; Ph.D., West Virginia University; P.E.,

Sofras, Pamela A. (1976); *Professor Emerita, Department of Dance;* B.F.A., The Juilliard School; M.Ed., Lehigh University

Sohn, David (1964); *Associate Professor Emeritus, Department of Psychology;* B.A., Brooklyn College; Ph.D., University of Texas at Austin

Sommer, John W. (1993); *Distinguished Professor Emeritus,; Professor Emeritus, Department of Geography and Department of Political Science*; A.B., Dartmouth College; A.M., Boston University; Ph.D., Boston University

St. Clair, Edward B. (1970); *Associate Professor Emeritus, Department of Religious Studies;* B.A., George Washington University; B.D., Southeastern Baptist Theological Seminary; Ph.D., Duke University

Stephenson, Katherine S. (1986); *Associate Professor Emerita, Department of Languages and Culture Studies;* B.A., Texas Christian University; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill

Stevenson, Thomas H. (1976); *Professor Emeritus, Department of Marketing;* B.S.B.A., Syracuse University; M.B.A., Syracuse University; Ph.D., Case Western Reserve University

Strassberg, Roy (2001); *Professor Emeritus, Department of Art and Art History;* B.A., State University of New York at Oswego; M.F.A., University of Michigan

Strawn, Martha Ann (1971); *Professor Emerita, Department of Art;* B.A., Florida State University; M.F.A., Ohio University

Studnicki, James (2006); *Professor Emeritus, Department of Public Health Sciences;* B.S., University of Pittsburgh; M.B.A., George Washington University; M.P.H., Johns Hopkins University; Ph.D., Johns Hopkins University

Summerville, Frances Lovenia (1968); *Associate Professor and Librarian Emerita, Atkins Library;* B.A., St. Andrews Presbyterian College; M.L.S., Peabody College

Suther, Judith D. (1979); *Professor Emerita, Department of Languages and Culture Studies;* B.A., University of Missouri; M.A., University of Michigan; Ph.D., University of Missouri

Swartz, Caroline (2006); *Clinical Professor Emerita, Department of Economics;* B.S., State University of New York at Fredonia; M.A., Duke University; Ph.D., Duke University

Swayne, Linda E. (1981); *Professor Emerita, Department of Marketing;* B.B.A., Stetson University; M.B.A., Stetson University; Ph.D., North Texas State University

Swisher, Michael T. (1988); *Associate Professor Emeritus, School of Architecture;* A.B., Washington University; M.F.A., Massachusetts College of Art

Tedeschi, Richard G. (1976); *Professor Emeritus, Department of Psychological Science;* B.A., Syracuse University; Ph.D., Ohio University

Terry, William Scott (1976); *Professor Emeritus, Department of Psychological Science;* B.A., Fairfield University; M.S., Yale University; Ph.D., Yale University

Test, David W. (1983); *Professor Emeritus, Department of Special Education and Child Development;* B.A., Eisenhower College; M.A., Ohio State University; Ph.D., Ohio State University

Testerman, Jane K. (1997); *Associate Professor Emerita, Department of Educational Leadership;* B.A., University of North Carolina at Charlotte; M.Ed., University of North Carolina at Charlotte; Ed.S., Appalachian State University; Ed.D., University of North Carolina at Greensboro

Thomas, Herman Edward (1974); *Professor Emeritus, Department of Religious Studies;* B.S., North Carolina A&T State University; B.D., Duke University; Th.M., Duke University; Ph.D., Hartford Seminary Foundation

Thomas, Mary Beth (1980); *Professor Emerita, Department of Biological Sciences;* B.A., Agnes Scott College; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill

Tierney, Barbara G. (1998); *Associate Professor and Librarian Emerita, Atkins Library;* B.A., Northwestern University; M.L.S.; M.L.S., University of Michigan

Tillotson, Joan S. (1973); *Associate Professor Emerita, Department of Applied Physiology, Health, and Clinical Sciences;* B.S., State University College of New York; M.A., State University of Iowa; Ph.D., State University of Iowa

Tite, Winston R. (1980); *Associate Professor Emeritus, Department of Art;* B.S., Weber State College; M.F.A., Arizona State University

Toenjes, Richard H. (1973); *Associate Professor Emeritus, Department of Philosophy;* B.A., St. Louis University; M.A., St. Louis University; Ph.D., University of Southern California

Tolley, Patricia A. (1995); *Associate Professor Emerita, Department of Engineering Technology and Construction Management;* B.S.M.E., University of North Carolina at Charlotte; M.S.M.E., University of North Carolina at Charlotte; Ph.D., University of North Carolina at Charlotte

Tong, Rosemarie (1999); *Distinguished Professor Emerita, Department of Philosophy;* B.A., Marygrove College; M.A., Catholic University of America; Ph.D., Temple University

Travis, Jim (1973); *Associate Professor Emeritus, Department of Biological Sciences;* B.S., East Texas State College; M.S., East Texas State College; Ph.D., Texas A&M University

Travis, Lucille L. (2006); *Professor Emerita, School of Nursing;* B.S.N., Ohio State University; M.S., Ohio State University; Ph.D., Ohio State University

Trosch, Louis A. (1969); *Professor Emeritus, Department of Finance;* B.A., Bethany College; M.A., George Washington University; J.D., West Virginia University

Tsu, Raphael (1988); *Professor Emeritus, Department of Electrical and Computer Engineering;* B.S., University of Dayton; M.S., Ohio State University; Ph.D., Ohio State University

Tyson, Robert K. (1999); *Associate Professor Emeritus, Department of Physics and Optical Science;* B.S., Pennsylvania State University; M.S., West Virginia University; Ph.D., West Virginia University

Vance, Christine W. (1974); *Associate Professor Emerita, Department of Languages and Culture Studies;* C.E.L.G., Universite de Paris et Lille, France; Licence-es-Lettres, Universite d' Alger-Aix-en-Provence, France; Licence-es-Lettres, Paris-Sorbonne University, France; M.A., Vanderbilt University; Ph.D., Vanderbilt University

VanSledright, Bruce A. (2011); *Professor, Department of Reading and Elementary Education;* B.A., Calvin College; M.A., Michigan State University; Ph.D., Michigan State University

Vermillion, Robert (1965); *Professor Emeritus, Department of Physics and Optical Science;* A.B., King College; M.S., Vanderbilt University; Ph.D., Vanderbilt University

Walcott, Wayne A. (1970); *Senior Associate Provost Emeritus, Academic Affairs; Associate Professor Emeritus, Department of Geography and Earth Sciences*; B.S., Western Michigan University; M.A., University of Illinois at Urbana-Champaign; Ph.D., University of Illinois at Urbana-Champaign

Walker, Judith A. (1987); *Professor Emerita, J. Murrey Atkins Library;* B.A., Montclair State College; M.L.I.S., The Catholic University of America

Walsh, Thomas (1970); *Associate Professor Emeritus, Department of Chemistry;* A.B., University of Notre Dame; Ph.D., University of California, Berkeley

Walters, David R. (1990); *Professor Emeritus, School of Architecture;* B.Arch., Newcastle University, England; M.Arch., Newcastle University, England

Wang, Sheng-Guo (1997); *Professor Emeritus, Department of Engineering Technology and Construction Management;* B.S., University of Science and Technology of China, China; M.S., University of Science and Technology of China, China; Ph.D., University of Houston

Watson Jr., Samuel D. (1973); *Professor Emeritus, Department of English;* B.A., Wofford College; M.A., University of Virginia; Ph.D., University of Iowa

Webster, Murray A. (1993); *Professor Emeritus, Department of Sociology;* A.B., Stanford University; M.A., Stanford University; Ph.D., Stanford University

Weekly, James K. (1988); *Professor Emeritus, Department of Marketing;* B.S., Indiana University; M.B.A., Indiana University; D.B.A., Indiana University

Weinstock, Barnet M. (1977); *Professor Emeritus, Department of Mathematics;* A.B., Columbia College; Ph.D., Massachusetts Institute of Technology

Whaley, Charles R. (1974); *Assistant Professor Emeritus, Department of Teaching Specialties;* A.B., Princeton University; M.A.T., University of North Carolina at Chapel Hill; Ph.D., University of Texas at Austin

White, Richard B. (1983); *Professor Emeritus, Department of Special Education and Child Development;* B.A., Miami University; M.S.Ed., Indiana University; Ed.D., Indiana University

Whitmeyer, Joseph M. (1993); *Professor Emeritus, Department of Sociology;* B.S., Wright State University; M.A., University of Washington; Ph.D., University of Washington

Wichnoski, Bruno J. (1974); *Associate Professor Emeritus, Department of Mathematics and Statistics;* B.S., Drexel University; M.S., Tulane University; Ph.D., Tulane University

Wierzalis, Edward (2002); *Clinical Assistant Professor Emeritus, Department of Counseling;* B.S., Pennsylvania State University; M.Ed., Temple University; Ph.D., University of Virginia

Wiggins, Jr., Casper E. (1999); *Distinguished Professor Emeritus, Turner School of Accountancy; B.A., Wofford College*; M.B.A., University of Georgia; M.S., Clemson University; D.B.A., University of Tennessee

Wihstutz, Volker (1987); *Professor Emeritus, Department of Mathematics and Statistics;* Diploma, University of Frankfurt, Germany; Ph.D., University of Bremen, Germany

Wilkinson, Anthony Barry (1987); *Professor Emeritus, Department of Computer Science;* B.Sc., University of Salford, England; M.Sc., University of Manchester, England; Ph.D., University of Manchester, England

Williams, Janet (2008); *Associate Professor Emerita, Department of Art and Art History;* B.A., Middlesex Polytechnic University; M.F.A., Cranbrook Academy of Art

Wilmoth, Margaret (Peggy) C. (1996); *Professor Emerita, School of Nursing;* B.S.N., University of Maryland; M.S., University of Maryland; Ph.D., University of Pennsylvania

Winecoff, Michael (2001); *Associate Dean for Collection Services Emeritus and Associate Professor Emeritus, J. Murrey Atkins Library;* B.A., University of North Carolina at Charlotte; M.L.S., University of North Carolina at Greensboro

Wood, Bret A. (2000); *Lecturer Emeritus, Department of Applied Physiology, Health, and Clinical Sciences;* B.S., West Virginia University; M.Ed., University of North Carolina at Charlotte

Wood, Karen D. (1985); *Professor Emerita, Department of Reading and Elementary Education;* B.A., Catawba College; M.A., Appalachian State University; Ed.S., Appalachian State University; Ph.D., University of Georgia

Wood, Wendy M. (1994); *Associate Professor Emerita, Department of Special Education and Child Development;* B.A., Lynchburg College; M.Ed., Virginia Commonwealth University; Ph.D., Virginia Commonwealth University

Woodward, James H. (1989); *Chancellor Emeritus and Professor Emeritus, Department of Civil and Environmental Engineering;* B.S.A.E., Georgia Institute of Technology; M.S.A.E., Georgia Institute of Technology; Ph.D., Georgia Institute of Technology; M.B.A., University of Alabama at Birmingham

Wright, Hazel Drye (1966); *Assistant Professor Emerita, Department of Mathematics;* B.S., Appalachian State Teachers College; M.A., Wake Forest College

Yon, Maria G. (1987); *Associate Professor Emerita, Department of Reading and Elementary Education;* B.S., Concord College; M.A., West Virginia University; Ed.D., Virginia Polytechnic Institute and State University

Young, David T. (1985); *Professor Emeritus, Department of Civil and Environmental Engineering;* B.S.C.E., Clemson University; M.S.C.E., Clemson University; Ph.D., Virginia Polytechnic Institute and State University

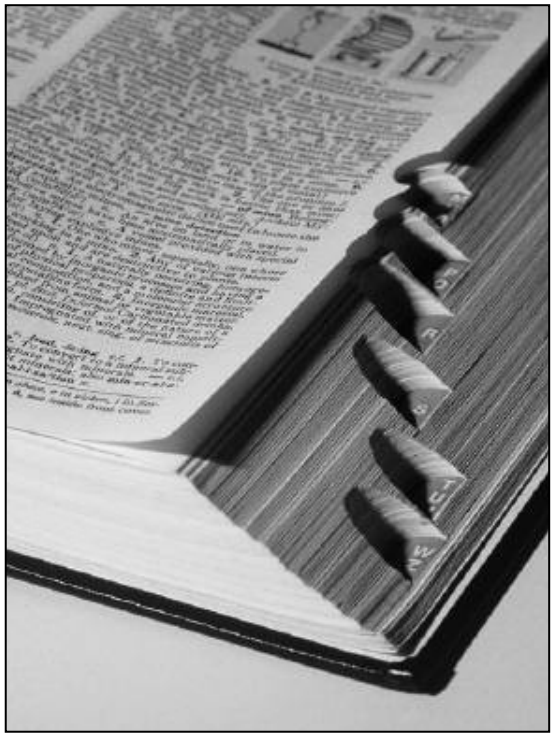
Zellars, Kelly L. (2000); *Professor Emerita, Department of Management;* B.A., University of Notre Dame; M.B.A., University of Notre Dame; M.S., University of Wisconsin-Milwaukee; Ph.D., Florida State University

Zhu, You-lan (1990); *Professor Emeritus, Department of Mathematics and Statistics;* Ph.D., Qinghua University, China

Ziegert, John C. (2010); *Professor Emeritus, Department of Mechanical Engineering and Engineering Science;* B.S.M.E., Purdue University; M.S., Northwestern University; Ph.D., University of Rhode Island

Zimmermann, Gerda Anna Maria (1974); *Associate Professor Emerita, Department of Dance;* Diploma, School for Gymnastics, Germany; License, School for Theater, Germany; License, School of Fine Arts, Germany

Zuber, Richard A. (1978); *Professor Emeritus, Department of Economics;* B.A., Wake Forest University; M.A., University of Kentucky; Ph.D., University of Kentucky



Glossary of Academic Terminology

-123-

49ers – The official name for student athletic teams at UNC Charlotte.

49er Card – The ID Card that proves a student is a member of the campus community and entitled to certain services. It is required to check out materials, obtain services, and utilize facilities across campus. It also allows students to access their residence, obtain meals, and make purchases wherever the 49er Account is accepted.

-A-

Academic advising – A meeting between a student and an advisor to discuss the student's academic plan of study, course selections prior to registration, and/or career plans.

Academic bridge program - A postsecondary school program that helps students transition from high school to a university.

Academic calendar – An official list of dates and deadlines found at the beginning of this *Catalog* and on the website for the Office of the Registrar. The academic calendar specifies the dates for semesters and terms, enrollment periods, examination periods, holidays, periods classes are not in session, and commencement.

Academic career – The period during which a student is working at an institution toward completion of one or more degrees.

Academic discipline – A subject area of study (e.g., English, marketing, psychology).

Academic Petition – An electronic form by which students request to be granted an academic exception because their extenuating circumstances prevent them from following established rules, policies, and procedures.

Academic probation – A status resulting from unsatisfactory academic work; a warning that the student must improve academic performance or be dismissed after a specific period of time.

Academic rank – the rank of a faculty member, such as professor, associate professor, assistant professor, or lecturer. *(See individual listings for details.)*

Academic record – Official transcript.

Academic standing – The scholastic standing of a student based on their grade point average (GPA).

Academic year – The period of formal academic instruction, extending from August through July. It is divided into Fall, Spring, and Summer semesters.

Access – Ensuring equal opportunity for education, particularly for students from historically underrepresented populations and students with disabilities.

Accommodations – Disability Services counselors meet with qualified students to determine and provide reasonable and appropriate accommodations that support the student's educational goals.

Accreditation – UNC Charlotte is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). SACSCOC is the recognized accrediting body in the eleven U.S. Southern states (Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Virginia) and in Latin America for those institutions of higher education that award associate, baccalaureate, master's, or doctoral degrees. Accreditation is certification that an institute of higher education meets a set of criteria established by SACSCOC.

Accrediting Body, Accepted - the following are accepted accrediting bodies: Accrediting Commission for Community and Junior Colleges (ACCJC) Western Association of Schools and Colleges, Higher Learning Commission (HLC), Middle States Commission on Higher Education (MSCHE), New England Commission of Higher Education (NECHE), Northwest Commission on Colleges and Universities (NWCCU), Southern Association of Colleges and Schools Commission on Colleges (SACSCOC), and WASC Senior College and University Commission (WSCUC).

ACT – A test published by **A**merican **C**ollege **T**esting which measures a student's aptitude in mathematical and verbal comprehension and problem solving. Many colleges and universities, including UNC Charlotte, require students to take this test and submit their test scores when they apply for admission. While UNC Charlotte accepts the ACT, the SAT is preferred. Most students take the ACT or the SAT during their junior or senior year of high school.

Add/Drop – A designated time period at the beginning of each semester when a student may add or drop a course without penalty. At UNC Charlotte, the Add/Drop period runs through the 6th business day of the Fall and Spring semesters, and through the 2nd business day for Summer full and half terms.

Adjunct faculty – Part-time or temporary faculty member. It may also denote a faculty member from another academic department whose research or teaching interests overlap substantially with those of the appointing department.

Admission to Candidacy- The period in a doctoral student's studies when they are deemed ready to undertake research resulting in a dissertation or scholarly project.

Admissions and Enrollment Counselor – A person working in the Office of Undergraduate Admissions or Office of Graduate Admissions who assists prospective students by providing information on admissions requirements, academic programs, and the application process.

Advanced Placement (AP) – Standardized courses administered by The College Board offered in high school, the completion of which may result in credit for some of the courses normally required for an undergraduate degree. Awarding of credit based on AP is granted to a student based on prior study or experience (usually indicated by the student's performance on the AP examination).

Advisor – For undergraduate students, a department or college-based faculty or staff member who meets with students each semester to discuss curricular choices and progress toward achieving educational goals. For graduate students, typically the Chair of the student's Thesis or Dissertation committee or academic mentor.

Alma mater – The school from which one has graduated, as in "My alma mater is The University of North Carolina at Charlotte."

Alumna/Alumnus (Alumni) – A female/male (group) who attended or graduated from a particular college or university.

Annotated bibliography – A list of citations of books, articles, and documents followed by a brief descriptive paragraph. The purpose of the annotation or description is to inform the reader of the relevance, accuracy, and quality of the sources cited.

Appeal - A formal, written narrative to request reinstatement following suspension or termination.

Articulation agreement – A written agreement listing courses at one educational institution that are equivalent to courses at another educational institution. Articulation agreements facilitate the smooth transition of students through the secondary, community college, and university educational systems.

Assessment – The act of evaluation or appraisal.

Assignment – Required reading and course work to be completed outside of the classroom as determined by instructors. Many instructors list assignments on a syllabus,

which is distributed at the beginning of the semester. Other instructors give assignments during class.

Assistant Professor – usually the entry-level rank for a faculty member who holds a doctorate, although this depends on the institution and the field.

Associate Professor – the mid-level rank of a faculty member. It usually indicates that the individual has been granted tenure at the institution.

Associate's degree – A degree traditionally awarded by community or junior colleges after two years of study, or completion of 60 to 64 credit hours.

Attempted hours - The credits received from courses completed at UNC Charlotte, regardless of grade earned, courses from which students withdrew (W or WE), and courses that were repeated (even if additional credit was not earned).

Audit – Enrolling in a course on an audit basis means the course will not count for credit or impact GPA. Registration for audit requires the permission of the instructor.

Auditory learner – Learns through listening; these students learn best through verbal lectures, discussions, talking things through, and listening to what others have to say. Auditory learners interpret the underlying meanings of speech through listening to tone of voice, pitch, speed and other nuances. Written information may have little meaning until it is heard. These learners often benefit from reading text aloud.

-B-

Bachelor's degree or baccalaureate – A postsecondary degree requiring 120 credit hours of specified coursework (except for programs that have applied for and received a waiver to exceed 120 credit hours from the UNC Charlotte Board of Trustees). A bachelor's degree is comprised of General Education courses, a major program(s), elective courses, and, in some cases, a minor program(s), and, in general, is completed in four years.

Blue book – A booklet (often with a blue cover, where it derives its name) that contains lined paper for writing essay test answers.

Bridge program – See *Academic bridge program*.

Bursar - The official at the University who oversees the office that provides quality account management service to students, parents, and alumni by proactively assisting them in meeting their financial responsibilities for attendance.

-C-

Cambridge International Examinations – Standardized courses administered by Cambridge Assessment International offered in high school, the completion of which may result in credit for some of the courses normally required for an undergraduate degree. Awarding of credit based on Advanced (A-Level) or Advanced Subsidiary (AS-Level) examinations is granted to a student based on prior study or experience (usually indicated by the student's performance on the A- or AS-level examinations).

Campus – The area where the main buildings of UNC Charlotte are located, both in University City (main campus) and Center City (Dubois Center).

Catalog – A resource of all academic policies and procedures, college and degree requirements, faculty, and course descriptions. UNC Charlotte has both an *Undergraduate Catalog* and *Graduate Catalog*.

Catalog year – The year during which the regulations of a specific edition of the catalog apply.

Certificate – A structured set of professionally oriented courses designed to provide recognition that the student has completed coursework in an applied area of focus. For degree-seeking students, a certificate program may either complement or be concurrent with a traditional program of study. The certificate appears on the official transcript.

CFNC – College Foundation of North Carolina. A comprehensive website used for applying to colleges, exploring career opportunities, and applying for state and federal aid.

Chancellor – The chief executive officer of UNC Charlotte. At some universities, this position is referred to as *president*. To date, UNC Charlotte has had six chancellors.

Chancellor's List – The top honors list which recognizes undergraduate students with outstanding records of academic performance (a GPA of 3.8 or greater) and who meet all other criteria. For details, see the Degree Requirements and Academic Policies section of this *Catalog*.

Class standing – Refers to an undergraduate student's official year in school - Freshman, Sophomore, Junior, or

Senior – and is based on the number of earned credit hours.

Classification – Level of progress toward a degree based on the number of earned semester/credit hours.

Clinical faculty – A part-time teaching position with limited research responsibilities.

College – An academic unit of the University. Each of the seven discipline-based colleges at UNC Charlotte represents an organization of related departments and/or schools.

Colloquium – A gathering of scholars to discuss a given topic over a period of a few hours to a few days.

Commencement *(also known as Graduation)* – A formal ceremony in which the University awards degrees to graduating students at the end of each Fall and Spring semester, pending receipt of satisfactory final grades.

Commencement Marshals – At each commencement ceremony, the University honors the juniors with the highest grade point averages by inviting them to serve as the marshals who lead the processions of graduates, faculty members, and the platform party.

Community college – A two-year traditional school, offering programs leading to an Associate's degree and, typically, many noncredit courses for community members not seeking a degree. Also called *junior college*.

Concentration – A structured plan of study within a major. *(For example, Public Relations is a concentration within the Communication Studies undergraduate major; Children's Literature is a concentration within the M.A. in English graduate program.)* The number of credit hours for a concentration varies, but is included within the credit hours for the major. The concentration appears on the official transcript.

Contact hours – The number of hours a class meets per week.

Continuing education course – A course outside the regular academic instructional program, for which standard academic fees and tuition are (usually) not charged. While most often these courses do not earn academic credits, they can provide necessary education or experience for professional development, or lead to professional certifications.

Continuous Registration - Enrollment in coursework or research credit every semester without interruption until graduation.

Convocation – The University Convocation is a gathering of senior administration, faculty, administrative staff, and students to hear statements about the major long-term goals and values of the campus, as well as the major immediate plans and issues confronting UNC Charlotte for the upcoming year, as perceived by the Chancellor, the Provost, and the Faculty President. It is hoped that these presentations will help build a greater shared understanding of the mission of the University and the challenges confronting it. The University Convocation is held at the beginning of the academic year. See also *Day of Convocation*.

Core courses – Required courses in a major program.

Corequisite – Specific conditions, requirements, or courses that must be completed while taking another course (i.e., a lab).

Course – A specific subject studied within a limited period of time. Courses may utilize lectures, discussion, laboratory, seminar, workshop, studio, independent study, internship, or other similar teaching formats to facilitate learning.

Course load – Number of credit hours for which a student is enrolled during a semester.

Course number – The four-letter and four-digit identification code that identifies each course taught at the University, such as ENGL 2126 or PSYC 8151.

Course overload – Defined at UNC Charlotte as over 18 credit hours for undergraduates and over 12 credit hours for graduates during full terms. Within half terms, it is defined as over 7 credit hours. Approval is required to take an overload.

Course sections – Course numbers may be divided when classes also meet in discussion sections, or when a course number has sections pertaining to different topics under the same heading. For instance, a course called Architecture Topical Studio may have section 001 – Cycloramic Models and section 002 – Building Envelopes.

Course title – The name of a specific course that indicates subject and content. *Introduction to Creative Writing* is the course title of ENGL 2126; *Behavior Disorders* is the course title for PSYC 8151.

Coursework - A specified amount of work undertaken in a course which leads to its completion; also, the courses taken to attain a degree in a specified program.

Credit course – A course with specified learning goals which the student is required to meet in order to receive a grade. The course may be applied toward the fulfillment of degree requirements at the University.

Credit hour – An amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

(1) 750 minutes of classroom or direct faculty instruction and a minimum of 1500 minutes of out-of-class student work for one semester hour of credit; or

(2) At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities or instructional modes of delivery as established by the institution including distance education, hybrid, and face-to-face instruction; laboratory work; internships; practica; studio work; and other academic work leading to the award of credit hours.

Critical thinking – The practice of thinking things through, in which a student must carefully describe something (an event, a book, a person, etc) and evaluate it according to some relevant criterion, considering significant alternatives. Critical thinking is a core component of *liberal education* and of the *general education curriculum.*

Cross-Listed Course – A single course which is simultaneously listed in the schedule of course offerings by one or more academic departments. They share the same meeting times, room, instructor(s), and curriculum. Therefore, ideally, they should also have the same course title. Students may only receive credit for the single section of the cross-listed course for which they are registered. Credit will not be awarded for a course where credit has already been awarded for its cross-listed equivalent.

Cum Laude – Honorary recognition of the success of a graduating student. Translates to "With Honor." For UNC Charlotte, it requires a cumulative GPA of at least 3.4, but less than 3.8.

Curriculum – A program of courses that meets the requirements for a degree in a particular field of study.

-D-

DBA - The Doctor of Business Administration is a professional degree taught in an executive format designed to prepare graduates for leadership positions in organizations and teaching careers in academia.

Dean – The highest authority within an academic division of study. An Academic Dean heads each College. In addition to the academic deans, there is also a Dean of Students within the Division of Student Affairs.

Dean's List – An honors list which recognizes undergraduate students who earn a grade point average of at least 3.4 and not more than 3.79 and meet all other criteria. For details, see the Academic Regulations section of this *Catalog.*

Deferment – The postponing of a fee or tuition, which will be paid at a later date.

Degree – Diploma or title awarded to a student who completed a prescribed course of study.

Degree program – An organized sequence of courses that leads to the awarding of a college degree at the undergraduate or graduate level. Sometimes referred to as *Curriculum.*

Degree requirement – A set of requirements, which a student must fulfill before they graduate.

Department/School – A unit within a college representing a discipline. For example, the Department of English is in the College of Liberal Arts & Sciences, and the School of Nursing is in the College of Health and Human Services.

Department chair – The faculty member in charge of an academic department of the university.

Directory Information - Information in a student's education record that would not generally be considered harmful or an invasion of privacy if disclosed. At UNC Charlotte, directory information consists of the student's name, major field of study, dates of attendance, enrollment status, and degrees and awards (including scholarships) received. See the Family Educational Rights and Privacy Act (FERPA) section of this Catalog for more details.

Disability – The physical and/or learning challenge -- permanent or temporary – of a student that may impact their academic plan. Accommodations are provided for students with documented disabilities.

Discipline – An area of study representing a branch of knowledge, such as psychology.

Dissertation – The major research project normally required as part of the work for a doctoral degree. Dissertations are expected to make a new and creative

contribution to the field of study, or to demonstrate one's excellence in the field.

Dissertation Chair – A graduate faculty member responsible for directing a doctoral student's dissertation research. This may or may not be the student's academic advisor.

Distance education/learning – Formal learning which occurs when students and instructor are separated by geographic distance or by time. Access to the instructor is gained through communications technology such as the Internet, interactive videoconferencing, and email.

DNP - The Doctor of Nursing Practice is a terminal degree designed to prepare graduates to analyze systems of care and provide transformational leadership to improve patient safety, quality of care, and implement evidence-based culturally competent care practices.

Doctoral degree – The most advanced degree, awarded following additional study, often after completion of a master's degree.

Double major – Studying simultaneously for two majors, fulfilling the course requirements for both majors.

Drop/Add – *See Add/Drop.*

Dual/joint degree – Involves a student's working for two different University degrees in parallel, either at the same institution or at different institutions (sometimes in different countries), completing them in less time than it would take to earn them separately. The two degrees might be in the same subject area (especially when the course is split between countries), or in two different subjects.

-E-

Early Entry - Accelerated program for students who begin graduate study during their undergraduate senior year.

Earned hours - The credits received from courses successfully completed at UNC Charlotte.

Ed.D. - The Doctor of Education is a terminal degree designed to prepare educational administrators who can assume mid-level and senior-level leadership positions in public school and postsecondary settings.

Elective course – A course selected at a student's discretion. A *restricted elective course* is a course which must be chosen from a stated group/list of courses to satisfy the program requirements. An *unrestricted elective course* may be in any subject, and may be selected from any course for which the student has the proper prerequisites.

Embargo - In academia, an "embargo" is a restriction placed on research, typically a thesis or dissertation, to be temporarily withheld from publication.

Emeritus faculty – A member of the faculty who has retired but retains the honorary title that corresponds with their last held position at the University.

Equivalency examination – An examination designed to demonstrate knowledge in a subject where the learning was acquired outside a traditional classroom. For example, a student who learned management skills while working at a restaurant could take an equivalency exam, if offered, to earn credit in small business management.

Essay – A method of examination, or homework, by which a student presents their knowledge of the subject by writing a composition.

Experiential learning – Actively engaging students in a work and/or educational experience where they may make their own discoveries and experiment with knowledge themselves, instead of hearing or reading about the experiences of others.

Extenuating circumstances – Personal situations that, upon administrative approval, allow students to withdraw late (if necessary) and to receive "WE" grades.

Extracurricular activities – Activities pertinent to student life, but not part of the regular classroom study (e.g., athletics, publications, and social organizations). Also referred to as *co-curricular activities*.

-F-

Facilitator – The person in an interactive classroom who assists the instructor or students with distribution of handouts, collection of tests and evaluations, technical and troubleshooting issues, etc.

Faculty – All persons who hold Professorial Rank (Professor, Associate Professor, and Assistant Professor) or a Special Faculty Appointment (Visiting Professor, Adjunct Professor, Instructor, Assistant Professor (Library), Assistant Professor (Military), Lecturer, Assistant Research Professor, or Artist-in-Residence).

FAFSA (**F**ree **A**pplication for **F**ederal **S**tudent **Aid**) – A form that all students applying for financial assistance are required to complete in order to determine eligibility for

financial aid. This form is available from the Office of Student Financial Aid.

FAQ – **F**requently **A**sked **Q**uestions. On the Internet and in print, information sources may provide a list of FAQs to assist newcomers in learning more on their own.

Fees – An amount of money charged by institutions (in addition to tuition) to cover the costs of certain services (health services, athletic center, student activities, registration, parking, use of lab equipment or computers, etc.).

FERPA – The **F**amily **E**ducational **R**ights and **P**rivacy **A**ct (FERPA) is a Federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education.

Final exam – The last, and often the most comprehensive, examination of the entire semester's course material.

Financial aid/assistance – Money available from various sources to help students pay for college. Students must establish eligibility. Funds can be competitive.

Financial aid package – Total amount of financial aid given to a student. Federal and non-Federal aid such as grants, loans, and work-study are combined to help meet the student's need.

Financial need – In the context of student financial aid, financial need is equal to the cost of education (estimated costs for college attendance and basic living expenses) minus the expected family contribution (the amount a student's family is expected to pay, which varies according to the family's financial resources).

Fraternity – A social organization, most often for male students, with specific objectives, rules and regulations.

Full-time student – An undergraduate student with a course load of at least 12 credit hours, as defined by eligibility for federal financial aid, or a graduate student with a course load of at least 9 credit hours. However, undergraduate students need to average a minimum course load of 15 credit hours per semester to graduate within four years.

-G-

General Education Requirements - These courses provide undergraduate students, regardless of their majors, with the foundations of a *liberal education*. For details, see the General Education Program section of the *Undergraduate Catalog*.

Good Academic Standing – Meeting the cumulative GPA requirements for a semester.

Good Academic Standing Warning – The result of unsatisfactory work during the course of a semester; a warning that the student should improve their performance.

GPA (Grade Point Average) – The grade point average for an undergraduate student is determined by adding all accumulated quality points together, and then dividing by the total number of GPA hours the student has attempted, excluding those for which the student received a grade of I, IP, W, WE, H, P, AU, or N. In computing the grade point average, only those credits attempted at UNC Charlotte are included. Refer to the example below.

Example of Transcript:

Subject	Course	Grade	Credit Hours	Quality Points
AMST	2050	P	3.000	0.00
CHEM	1251	F	3.000	0.00
CHEM	1251L	F	1.000	0.00
UWRT	1101	B	3.000	9.00
ENGR	1201	C	2.000	4.00
LBST	2101	C	3.000	6.00
MATH	1241	C	3.000	6.00

Term Totals (Undergraduate)

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term	18.000	14.000	14.000	15.000	25.00	1.666
Cumulative	18.000	14.000	14.000	15.000	25.00	1.666

Example of GPA Calculation:
GPA = Quality Points/GPA Hours; 25/15=1.666

Grades – Evaluative scores provided for each course, and often for individual assignments, examinations, or papers written for that course. There are letter grades (usually A, B, C, D, F) and number grades (usually percentages from 0% to 100%, or on a scale of 0.0 to 4.0). Some undergraduate courses use a *pass/no credit* system with no grades; some graduate courses use a *pass/unsatisfactory* system with no grades.

Graduate assistantship- Employment whereby a graduate student receives financial support for their contributions to the teaching, research, and service missions of the University.

Graduate Faculty Representative - A member of the doctoral student's advisory committee appointed by the Graduate School that assures that the doctoral student is treated fairly and impartially by his or her advisory committee, and assure that University standards and policies are upheld.

Graduate School - The academic college of which all graduate students belong, responsible for the administration of all graduate programs.

Graduate studies – Coursework beyond the bachelor's degree that leads to a graduate certificate, or a master's, professional, or doctoral degree.

Graduation *(also known as Commencement)* – A formal ceremony in which the University awards degrees to graduating students at the end of each Fall and Spring semester, pending receipt of satisfactory final grades.

Graduation with Distinction – Graduating with honors. To be eligible to graduate with distinction, a student must have a certain grade point average computed on at least 48 credit hours of credit completed in residence at UNC Charlotte. *(See Summa Cum Laude, Magna Cum Laude, and Cum Laude)*

Grant – A sum of money given to a student for the purposes of paying at least part of the cost of college. Grants and scholarships do not have to be repaid.

GRE (Graduate Record Examination) – A standardized test that is an admissions requirement for many graduate programs. The exam aims to measure verbal reasoning, quantitative reasoning, analytical writing, and critical thinking skills that have been acquired over a long period of time and that are not related to any specific field of study. The GRE General Test is offered as a computer-based exam administered by selected qualified testing centers.

-H-

Hold Flags – *See Registration hold flags.*

Homecoming – An annual event held by the University to honor alumni.

Honors – A special rank or distinction conferred by the University upon an undergraduate student for excellence in scholarship (based on their GPA). When referring to a course of study, an honors course is for academically talented, enthusiastic, and motivated undergraduate students.

Hooding - The Doctoral Hooding Ceremony is a tradition of individually recognizing graduating doctoral students through a separate event, prior to the University Commencement ceremony.

-I-

In-residence - For degree-seeking students, a residency requirement indicates the number of credit hours that must be completed through the University in order to graduate.

Incomplete grade – An "I" (incomplete grade) may be assigned by a faculty member to a student who carried coursework satisfactorily until near the end of the semester, but who was then unable to complete the course, possibly including the final exam. If the student does not remove the "I" within 12 months, the "I" will be changed to "F," "U," or "N," as appropriate. See the Degree Requirements and Academic Policies section of this *Catalog* for complete details.

Independent study – A method of receiving credit for study or research independent of the assignments of any specific course, but supervised and graded by a faculty member.

Interdisciplinary – A course or program of study involving two or more major areas/departments. For example, Women's and Gender Studies is an interdisciplinary program offering a minor within the College of Liberal Arts & Sciences.

International Baccalaureate (IB) – Standardized courses offered in high school, the completion of which may result in credit for some of the courses normally required for an undergraduate degree. Awarding of credit based on IB is granted to a student based on prior study or experience (usually indicated by the student's performance on IB examinations).

Internet course – A web-based course completed online. Also called an *online course*. May or may not be self-paced.

Internship – A work experience, paid or non-paid, that provides students with practical experience, most often in their field of study.

Intramural/fitness/sport clubs – Programs designed to encourage students to participate in a variety of competitive, instructional, and recreational organized sports activities.

-J-

Job fair – Also known as a *career fair* or *career expo*, it provides a place for employers and recruiters, to meet with student job seekers, typically for entry-level positions. Fairs usually include company or organization tables or

booths where résumés may be collected. Occasionally, it is also where students may perform their first interviews with a prospective employer.

Juris Doctor (J.D.) – A professional doctorate and first professional graduate degree in law.

-K-

Kinesthetic learner – A student who learns best by actually carrying out a physical activity, rather than listening to a lecture or merely watching a demonstration.

-L-

Laboratory (lab) – A classroom where students apply material in small-group situations that include experiments, assignments, and projects. A lab course typically has an "L" after the course number.

Learning communities – Small groups of new students and faculty who share common interests. Students enroll in two or more of the same courses and, in many cases, live together in the same residence hall.

Learning strategies – Activities that help people use their own learning style to best approach new learning.

Learning style – The way a person takes in, understands, expresses and remembers information; the way a person learns best. *See auditory, kinesthetic, and visual learner.*

Leave of Absence – Graduate students only may seek a leave from their studies for up to 12 months. During this time, they may not use any University resources.

Lecture – A teaching method in which the professor presents information to the students who take notes, ask questions, and have dialogue with the professor.

Liberal Education – The foundation of the baccalaureate degree in the United States. *Liberal education* strives to make students liberally educated citizens of the world by emphasizing knowledge across disciplines, critical thinking, and application of content. The *General Education Requirements* work toward this end.

Loan – A type of financial aid that is available to students. An education loan must be repaid. In some cases, payments do not begin until the student finishes school.

Lower division course – A course that is intended for freshman and sophomore level students (typically 1000 and 2000 course numbers) that contains introductory content.

-M-

Magna Cum Laude – High honorary recognition of the success of a graduating student. Translates to "With Great Honor." For UNC Charlotte, it requires a cumulative GPA of at least 3.8, but less than 4.0.

Major – A degree-seeking student's primary field of study. A major is a structured plan of study requiring a minimum of 30 credit hours. It must be feasible for undergraduate students to complete degree requirements within 120 credit hours (except for programs that have applied for and received a waiver to exceed 120 credit hours from the UNC Charlotte Board of Trustees). The major appears on the official transcript.

M.A./M.S. – See *Master's degree.*

Master's degree – An advanced degree (e.g., Master of Arts [M.A.], Master of Science [M.S.]) awarded by a university after completion of studies beyond a bachelor's degree.

Matriculated student – A student who has been accepted for admission to the University, has registered in a curriculum, and is pursuing courses toward a degree or certificate. See also *Non-matriculated student.*

Matriculation – The first enrollment following admission as a student.

Meta-Major – Collections of academic majors that have related courses. Undergraduate students within the University College will have several Meta-Major options to choose from. Meta-Majors provide a clear pathway to declaring a major and help make connections between academics and different career tracks.

Mid-term exam – An (often major) examination given in the middle of the semester that tests the student's knowledge of information taught in the course from the beginning of the course up until the time of examination.

Minor – An undergraduate minor represents an optional, secondary field of study for a degree-seeking undergraduate student; no undergraduate student may declare a major and a minor in the same discipline. An undergraduate minor is a structured plan of study requiring a minimum of 15 credit hours and no more than 29 credit hours exclusive of student teaching. A minor should require significant additional coursework beyond what is

already required for the major. The minor appears on the official transcript.

Multiple-choice examination – An examination in which questions are followed by two or more answers, from which a student selects the correct answer.

My UNC Charlotte – One-stop shopping for student services via the Web. It combines various systems, user interfaces, and technical solutions already available to the UNC Charlotte community in a single, consistent web-based interface. Students should use My UNC Charlotte online at my.charlotte.edu to access web-enabled student services, course information, e-mail, and calendar scheduling.

-N-

New Student Convocation - An event dedicated to welcome and introduce new undergraduate students (freshmen and transfers) to the UNC Charlotte academic community. During the event, students learn about UNC Charlotte's traditions, mission, and values that drive the niner spirit.

Niner Central – UNC Charlotte's place to go when you don't know where to go. Students can get answers to questions and receive services for all topics related to financial aid and billing, registration, transcripts, student accounts, academic records, and more.

Niner Nation – The collective UNC Charlotte student body.

Niner Nation Family – The collective parent and family members of UNC Charlotte students.

Noble Niner – The honor code created by the Student Government Association which solidifies the high standard of morals, principles, and integrity that all students should strive to uphold in order to bolster the growing reputation of excellence at UNC Charlotte.

Non-credit course – A class that typically meets less frequently than a credit course and that contributes toward personal or occupational development.

Non-matriculated student – A student who has been accepted for admission to the University, but not yet enrolled. See also *Matriculated student.*

-O-

Objective test – An examination in which questions requiring a very short answer are posed. It can be multiple choice, true/false, fill-in-the-blank, etc. The questions are related to facts (thus objective) rather than to opinions (subjective).

Online courses – Courses which are taught and taken either partially or wholly over the Internet.

Open-book examination – A student is permitted to use their textbook, and often classroom notes, during the exam.

Oral examination – A student answers questions by speaking rather than by writing.

Orientation – An organized gathering, held at the beginning of every semester, which provides useful information to new students to acclimate them with the college campus and student life.

-P-

Part-time student – An undergraduate student with a course load of less than 12 credit hours, or a graduate student with less than 9 credit hours. See also *Full-time student.*

Pass/no credit course – A course that rates a student's performance on a pass/no credit basis, rather than on grades.

Ph.D. – The Doctor of Philosophy a type of doctoral degree awarded by a university to students who have completed studies beyond the bachelor's and/or master's degrees, and who have demonstrated their academic ability in oral and/or written examinations and through original research presented in the form of a dissertation (thesis).

Placement test – An examination used to test a student's academic ability in a certain subject so they can be placed in a course at an appropriate level. In some cases, students may get course credits after scoring high on a placement test.

Plagiarism – Passing off someone else's work as your own or using the intellectual property of someone else without giving proper credit. Students must follow certain guidelines to properly acknowledge the use of other people's ideas or words in their work (unless such information is recognized as common knowledge). This is

considered a serious offense at every institution, and is subject to disciplinary action that may include failure in a course and/or dismissal from the University.

Pop quiz – A quiz that the instructor has not previously informed the students about.

Postbaccalaureate - A student who has earned a baccalaureate degree and takes educational courses; sometimes referred to as a "post-bacc" or non-degree seeking student.

Postsecondary education – Refers to all education for students after high school, including programs at community colleges, technical colleges, and four-year colleges and universities.

Prerequisites – Specific conditions, requirements, or courses that must be completed before enrolling in another course. Course prerequisites (if any) can be found within each course description. For example, Spanish I is a prerequisite for Spanish II.

Proctor – A person who supervises the taking of an examination to be certain there is no cheating, and that other rules are followed.

Professional development courses – Courses offered to improve knowledge and skills in specific professional areas, such as professional certification programs. They are usually not offered for academic credit.

Professor – the highest rank attained by a faculty member. Sometimes also called *Full Professor*. A small fraction of tenured faculty are awarded the title of *Distinguished Professor* to recognize outstanding and broad contributions to the advancement of a field of study.

Provost – Reporting to the Chancellor, the Provost is the chief academic officer who oversees all academic affairs activities, including research and faculty. The Deans of each College report to the Provost.

-Q-

Quiz – A short test, written or oral, usually less formal and usually carries less grade weight than an exam.

-R-

Reading Day – Reading Day is to guarantee that students have one day between scheduled classes and the first final examination day. Per the Academic Calendar policy, faculty must not require student participation in any course-related activities on Reading Day.

Readmission – Approval of the enrollment or admission of a former student.

Reassignment of Duties – A period of time (usually one semester) when a faculty member is not teaching, but concentrating on their own education or research.

Registrar – The official at the University who is responsible for maintaining student records. The Office of the Registrar plans and oversees registration, academic record maintenance, transcript preparation, graduation, a degree audit report system, and curricular records.

Registration – Students select courses to enroll in for the subsequent term.

Registration hold flags - Students may be blocked from registering for courses by “hold flags” that may be placed for various reasons, including College or departmental advising requirements, invalid admissions status, outstanding financial obligations, unreturned equipment or library materials, suspension and disciplinary action, or non-compliance with the North Carolina Immunization Law.

Reinstatement - Re-establishment of a student’s active status following a successful suspension/termination appeal or an approved leave of absence.

Required courses – Courses that a student must take in order to complete their degree. In many cases, these courses must be passed with a grade of C or above.

Research paper – A formal written report that includes research findings and a student's own ideas.

Residence - For degree-seeking students, a residency requirement indicates the number of credit hours that must be completed through the University in order to graduate.

Restricted elective course – See *Elective course.*

ROTC – **R**eserve **O**fficers **T**raining **C**orps program; a scholarship program wherein the military covers the cost of tuition, fees, and textbooks, and also provides a monthly allowance. Scholarship recipients participate in summer training while in college and fulfill a military service commitment after college.

-S-

SAT – **S**cholastic **A**ssessment **T**est I: Reasoning (SAT Reasoning Test) is a standardized test for college admissions that measures a student's aptitude in math,

critical reading, and writing. Many colleges and universities, including UNC Charlotte, require students to take this test and submit their test scores when they apply for admission. UNC Charlotte also accepts the ACT, but the SAT is preferred. Most students take the SAT or the ACT during their junior or senior year of high school.

Schedule of classes – A list of available courses for a specific period of study (i.e., Fall semester), including course numbers, hours, locations, and other pertinent information.

Scholarship – A sum of money given to a student for the purposes of paying at least part of the cost of college. Scholarships can be awarded to students based on academic achievements, financial need, or on many other factors. Scholarships, like grants, do not have to be repaid.

School – *See Department/School.*

Section – One of several classes of the same course. At UNC Charlotte, a three-digit code is used to identify each section of each course offered. For instance, a course called Architecture Topical Studio may have section 001 – Cycloramic Models and section 002 – Building Envelopes.

Self-directed learning – A process in which students take the initiative to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes. The instructor is available as a guide.

Semester or Term – A period of study of approximately 16 weeks, usually a third of the academic year (i.e., Fall, Spring, and Summer semesters). The Fall semester begins in August, the Spring semester in January, and the Summer semester in May at UNC Charlotte. The Summer semester generally includes one eleven-week and two five-week half terms.

Semester hour – See *Credit hour.*

Seminar – Most commonly offered as upper-level and graduate courses, these are small classes of approximately 15 students each, designed to facilitate intensive study of specific subject areas.

Service Learning (SL) – Any course with an SL designation must include the scholarly exploration of the concepts of citizenship, public or community service, social issues, or social justice, and provide learning via direct, hands-on experience outside of the classroom.

SOAR – **S**tudent **O**rientation, **A**dvising, and **R**egistration. It is the official UNC Charlotte orientation for new undergraduate students.

Sorority – A social organization for female students, with specific objectives, rules and regulations.

Student Convocation – See *Day of Convocation.*

Study abroad – Visiting other countries for educational purposes, including earning academic credit, learning about different cultures, and developing a deeper understanding of the global marketplace.

Subjective test – An examination in which the answers are in the form of narrative sentences, or long or short essays, often expressing opinions (thus subjective) rather than reporting facts (objective).

Summa Cum Laude – The highest honorary recognition of the success of a graduating student. Translates to "With Highest Honor." For UNC Charlotte, it requires a cumulative GPA of 4.0.

Supplemental Instruction – Additional assistance for students in historically difficult courses, including accounting, biology, chemistry, communication studies, engineering, mathematics, and physics.

Surveys – A method for collecting information to improve the experience for future students. Current students are often asked to complete questionnaires or participate in focus groups to provide feedback on the quality of services and impact of educational programs.

Suspension - Administrative cancellation of enrollment due to unsatisfactory academic performance.

Syllabus – A course outline typically provided on the first day of class by the instructor that describes course requirements, topics to be covered, required reading, grading criteria, faculty expectations, deadlines, exam dates, class attendance requirements, and other relevant course information.

-T-

Take-home examination – An examination that may be completed at home. Since students may use additional resources, these exams are usually more difficult than in-class exams.

Term – See *Semester or Term.*

Term paper – A written original work discussing a topic in detail, usually several typed pages in length. Often due at the end of a semester.

Termination (Academic) - Administrative cancellation of enrollment for failure to make satisfactory academic progress following an initial program probation or suspension. Students who are suspended from a graduate program and are denied re-admittance through the suspension appeal process are considered terminated.

Test – An examination, or any other procedure that measures the academic abilities of students.

Thesis - A long essay or dissertation involving personal research, written by a candidate for a graduate degree.

Transcript – A list of all the courses a student has transferred in or taken at UNC Charlotte with the grades that the student earned in each course at UNC Charlotte. A transcript is an exact and complete record of a student's academic history. The University requires a high school transcript when a student applies for admission.

Transferability – The extent to which a course taken from one college or university may be accepted by another. Full or partial transfer of the credit may be available, dependent on factors such as whether the receiving college or university offers an equivalent or similar course at comparable levels of academic expectation for learning. Academic advisors have information about whether and how specific courses will transfer to their institutions and degree programs.

Transfer student – A student who has earned credit in one college or university, and then transfers to another.

Transient study – When credit for courses taken by current UNC Charlotte students at a college or university accredited by an accepted accrediting body are transferred to UNC Charlotte, subject to approval. For details, see the Degree Requirements and Academic Regulations section of this *Catalog*.

True/False examination – An examination in which questions are answered by marking "True" or "False."

Tuition – The amount of money that colleges charge for coursework and other instruction. Tuition can vary widely between educational institutions, and does not cover fees, cost of books, and other materials.

Tuition waiver – A form of financial assistance in which the university may charge little or no tuition.

Tutoring – A method of providing help to students through additional instruction outside of class. Advanced students work with individuals or small groups to increase their understanding of the material.

-U-

Undeclared – A student who has not yet declared a major field of study; sometimes referred to as *undecided*.

Undergraduate studies – A two or four-year program in a college or a university, following high school graduation, which leads to an associate or bachelor's degree, respectively.

University-sanctioned activities - A University-sanctioned event or activity shall be one in which a student represents the University to external constituencies in academic or extracurricular activities including but not limited to University clubs, organizations, athletics, music ensemble tours, teams, and conferences.

Unrestricted elective course – See *Elective course*.

Unsatisfactory grade reports – notifications sent to students in the middle of each semester for courses in which the student is performing below average and a grade has been reported.

Upper-division course – A course that is intended for junior and senior level students (typically 3000 and 4000 course numbers) that contains advanced, and typically more specific, topic content.

-V-

Visiting faculty – Faculty members who come to the university from another institution for an appointment of a year or less, sometimes to fill a temporary vacancy.

Visual learner – Learns through seeing; these students prefer to see the instructor's body language and facial expression to fully understand the content of a lesson. They tend to prefer sitting at the front of the classroom to avoid visual obstructions (e.g., people's heads). They may think in pictures and learn best from visual displays including – diagrams, illustrated text books, overhead transparencies, videos, flipcharts, and hand-outs. During a lecture or classroom discussion, visual learners often prefer to take detailed notes to absorb the information.

-W-

Withdrawal – The procedure in which a student officially removes himself/herself from taking a course, or removes himself/herself from all courses. Tuition may or may not be refunded, depending on the date of withdrawal.

Withdrawal with Extenuating Circumstances (WE) - A Withdrawal with Extenuating Circumstances is for students who are unable to complete their coursework due to an unforeseen circumstance that may include, but not be limited to Personal/Family Emergency, Personal Hardship, Medical/Mental Health Emergency or Military Orders.

W-limit hours – The maximum number of credit hours (currently 16) for which undergraduate students are allowed to receive a grade of W over their academic career at UNC Charlotte.

Index

123

49ers....33
  Fight Song....33
49er Card/Student ID....85

A

Academic Advising *(refer to each program's description)*
Academic Affairs, Division of....17
Academic Buildings....18
Academic Calendar....5
Academic Integrity....47
Academic Load/Time Status for Grad Students....57
Academic Policies....59
Academic Records and Transcripts....79
Academic Standing....63
Academic Suspension....63
Academic Termination....63
Academically/Intellectually Gifted *(see Special Education)*
Accelerated Master's Programs....54
Accountancy....108
  Master of Accountancy....108
  Courses in Accounting....453
Accreditations....12
Add/Drop Period....53
Admission to The Graduate School....39
  Health Requirements....44
  Readmission....37, 64
Africana Studies....325
  Graduate Certificate in Africana Studies....325
  Courses in Africana Studies....458
Alcohol Abuse....49
Alma Mater....33
Anthropology....327
  M.A. in Anthropology....327
  MPH/M.A. in Anthropology Dual Degree....318
  Courses in Anthropology....459
Appeals
  Academic Suspension....63
  Academic Termination....64
  Admission....43
  Final Grades....62
  Tuition Refunds....91
Application for Degree/Graduate Certificate....57
Application for Graduate School/Programs
  Appeal Procedures....43
  Deadlines....39
  Fee....40, 86
  Materials....39
  Processing....40
  Requirements, General....40
    International Applicants....43
    Doctoral Degree Programs....40
    Master's Degree Programs....41
    Graduate Certificate Programs....41
    Post-Baccalaureate (Non-Degree) Programs....42
  Status....40
  Test Information....43
  Updating....40
Applied Physiology, Health, & Clinical Sciences....284
Architecture....92
  Master of Architecture....93
  M.S. in Architecture....98
  Master of Urban Design....99
  Master of Arch & Urban Design Dual Degree....101
  Master of Arch & M.S. in Info Tech Dual Degree....102
  M.S. in Arch & M.S. in Info Tech Dual Degree....104
  Courses in Architecture....461
  Courses in Urban Design....671
Art Education
  Graduate Certificate in Teaching: Art Education....194
  Courses in Art Education....464
Arts + Architecture, College of....92
Arts and Sciences *(see Liberal Arts & Sciences)*
Assistantships, Graduate *(see Financial Aid)*

Athletic Training
M.S. in Athletic Training 284
Courses in Athletic Training 464
Attendance and Participation, Course 59
Auditing Courses 53
Autism Spectrum Disorders *(see Special Education)*

B

Bioinformatics and Genomics 139
Ph.D. Bioinformatics/Computational Biology 139
M.S. in Bioinformatics 141
Grad Certificate Bioinformatics Applications 143
Grad Certificate Bioinformatics Technology 143
Courses in Bioinformatics 467
Biology 329
Ph.D. in Biology 329
M.S. in Biology 332
Graduate Certificate in Biomedical Sciences 334
Graduate Certificate in Biotechnology 335
Courses in Biology 473
Board of Governors 15
Board of Trustees 15
Business, Belk College of 107
Business Administration 111
Doctor of Business Administration (DBA) 111
Ph.D. in Business Administration 113
Master of Business Administration (MBA) 117
MBA/MHA Dual Degree 120
MBA/M.S. in Mathematical Finance Dual Degree 133
MBA/M.S. in Real Estate Dual Degree 136
MBA in Global Business & Strategy Dual 127
MBA PLUS Post-Master's Certificate 121
Graduate Certificate in Business Analytics 121
Grad Certificate in Entrepreneurship & Innovation 122
Courses in Business Administration 466, 477, 637
Business Information Systems and Operations Mgmt
Courses in Business Information Systems 600
Business Affairs, Division of 17

C

Campus Academic Buildings 18
Campus Map 831
Campuses 17
Catalog Policies and Disclaimers 7
Center City 17, 23
Center for Graduate Life & Learning 37
Certificate Programs *(see Graduate Certificate Programs)*
Chancellor 3, 15, 737
Change of Degree Program 56
Cheating 47
Chemistry 337
Ph.D. in Nanoscale Science 407
M.S. in Chemistry 337
Courses in Chemistry 489
Courses in Nanoscale Science 673
Child and Family Studies 167
M.Ed. in Child and Family Studies 167
M.Ed. in Special Education & Child Development 226
M.A.T. in Child and Family Studies 168
Grad Certificate Child & Family Dev (B-K) 169
Grad Certificate Early Child Mental Health 170
Courses in Child and Family Development 492
Civil and Environmental Engineering 212
Ph.D. in Civil Engineering 242
Ph.D. Infrastructure/Environmental Systems 270
M.S. in Civil Engineering 247
M.S. in Engineering 247
Courses in Civil/Environmental Engineering 478
Code of Student Academic Integrity 47
Code of Student Responsibility 48
Cognitive Science 339
Graduate Certificate in Cognitive Science 339
Communication Studies 340
M.A. in Communication Studies 340
Courses in Communication Studies 498
Computer Engineering
M.S. in Computer Engineering 257
Courses in Computer Engineering 510
Computer Science 144
M.S. in Computer Science 144
Master of Arch & M.S. in Info Tech Dual Degree 102
Graduate Certificate/Applied Artificial Intelligence 147
Graduate Certificate/Game Design & Dev 147
Courses in Computer Science 601
Computing and Informatics, College of 138
Computing and Information Systems 148
Ph.D. in Computing & Information Systems 148
Courses in Computing & Information Systems 624
Construction and Facilities Engineering 251
M.S. Construction & Facilities Engineering 251
Courses in Construction & Facilities Management 496
Continuous Registration 55
Corequisites 452
Counseling 172
Ph.D. in Counselor Education & Supervision 172
M.A. in Counseling 174
Post-Master's Certificate in Addiction Counseling 176
Graduate Certificate in Play Therapy 176
Post-Master's Certificate School Counseling 177
Courses in Counseling 499
Course Descriptions 450
Course Load *(see Academic Load)*
Course Numbering System 451
Creative Writing *(see English)*
Credit by Examination 56
Fee 86
Criminal Justice 342
M.S. in Criminal Justice 342
Graduate Certificate in Crime Analysis 343
Courses in Criminal Justice 494
Cross-Listed Courses 452

Curriculum and Instruction 178
Ph.D. in Curriculum and Instruction 179
M.Ed. in Curriculum and Instruction 185
M.A.T. in MIddle and Secondary Education 190
Grad Cert in Teaching - Middle & Secondary Ed 192
Grad Cert in Teaching - Art Education 194
Grad Cert in Common Core Instruction 195
Grad Cert in National Board Certification 196
Courses in Curriculum and Instruction 527
Courses in Middle Grades Education 644
Courses in Middle, Secondary, & K-12 Education 645
Courses in Secondary Education 715
Curriculum and Supervision *(See Educational Leadership)*
Cybersecurity
M.S. in Cybersecurity 155

D

Data Science, School of 443
Data Science and Business Analytics 443
M.S. in Data Science and Business Analytics 443
Grad Certificate - Data Science/Business Analytics 445
Courses in Data Science and Business Analytics 507
Definition of Terms *(see Glossary)*
Degree and Non-Degree Programs 8
Application for 57
Audits/DegreeWorks 57
Change of 56
New this Year 6
Requirements 53
Master's 66
Ph.D. 68
DBA 71
Ed.D. 73
DNP 75
Graduate Certificate 78
Second Degree 57
Directory, Faculty 737
Disciplinary Suspension 66
Doctoral Degree Programs 8, 36
Application Requirements 40
Program Requirements 68, 71, 73, 75
Drop or Withdrawal from a Course 52, 58
Drugs, Illegal 49
Dual Master's Degrees 57
Dual Undergraduate and Graduate Registration 55

E

Early Entry to Graduate Programs 54
Earth Sciences
M.S. in Earth Sciences 371
Courses in Earth Sciences 555
Courses in Geology 573
Economics 123
M.S. in Economics 123
M.S. in Economics/M.Sc. in Economics and Business Administration Dual Degree 127
M.S. in Economics/M.S. in Mathematical Finance Dual Degree 134
Graduate Certificate in Econometrics 126
Courses in Economics 525
Education, Cato College of 165
Education Courses (EDUC) 535
Educational Leadership & School Administration 197
Ed.D. in Educational Leadership 197
M.Ed. in Educational Leadership 201
Master of School Administration 202
Post-Master's Cert in School Administration 203
Graduate Cert in University & College Teaching 204
Courses in Curriculum and Supervision 506
Courses in Educ Leadership/School Admin 454
Educational Research, Measurement, & Evaluation 205
Ph.D. in Educational Research, Msmt & Evaluation 205
Grad Certificate in Quantitative Analyses 206
Courses in Educational Research, Msmt, & Eval 712
Electrical and Computer Engineering 254
Ph.D. in Electrical Engineering 254
M.S. in Computer Engineering 257
M.S. in Electrical Engineering 258
Courses in Electrical and Computer Engineering 510
Elementary Education 207
M.Ed. in Elementary Education 207
M.A.T. in Elementary Education 209
Graduate Cert in Teaching Elementary Ed 211
Graduate Cert in Elementary Mathematics Ed 212
Graduate Cert in Instructional Coaching 213
Courses in Elementary Education 539
Emergency Management *(see Public Administration)*
Energy and Electromechanical Engineering 262
M.S. Applied Energy/Electromech Engineering 262
Graduate Certificate in Applied Energy 264
Courses in Energy/Electromechanical Engineering 546
Engineering, William States Lee College of 240
Courses in Engineering (ENGR) 535
Engineering Management 265
M.S. in Engineering Management 265
Courses in Engineering Management 542
Engineering Technology
Courses in Engineering Technology 558
English 344
M.A. in English 344
M.A. English/M.F.A. Creative Writing Dual Degree 354
Graduate Certificate in Applied Linguistics 356
Graduate Certificate Technical/Prof Writing 357
Courses in English 548
English as a Second Language *(see Teaching English...)*
Ethics and Applied Philosophy 358
MA in Ethics and Applied Philosophy 358
Graduate Certificate in Applied Ethics 359
Courses in Philosophy 694

F

Faculty Directory....737
Family Educational Rights/Privacy Act (FERPA)....79
Fees....85
Fellowships *(see Financial Aid)*
Final Grades....62
Finance *(see Mathematical Finance)*
Financial Aid....88
Financial Information....84
Fire Protection and Safety Management....268
  Master of Fire Protection & Safety Management....268
  Courses in Fire Protection & Safety Management....663
Foreign Language Education....214
  M.A.T. in Foreign Language Education....214
  Graduate Certificate in Teaching - Foreign Language Education....216
  Courses in Foreign Language Education....560
  Courses in Foreign Languages *(see Languages and Culture Studies and individual languages)*
French *(see also Foreign Language Education and Languages and Culture Studies*
  Graduate Certificate in Languages and Culture Studies: Translating....390
  Courses in French....561
  Courses in Translating and Translation Studies....734

G

Gender, Sexuality, & Women's Studies....360
  Graduate Cert in Gender, Sexuality, & Women's....360
  Courses in Women's and Gender Studies....735
Geography and Earth Sciences....361
  Ph.D. in Geography....361
  M.A. in Geography....366
  M.S. in Earth Sciences....371
  Graduate Certificate in GIS&T....375
  Courses in Earth Sciences....555
  Courses in Geography....562
  Courses in Geology....573
Geology *(see also Geography and Earth Sciences)*
  Courses in Geology....573
Gerontology....376
  Graduate Certificate in Gerontology....377
  Courses in Gerontology....579
German *(see also Foreign Language Education and Languages and Culture Studies)*
  Graduate Certificate in Languages and Culture Studies: Business Languages....388
  Graduate Certificate in Languages and Culture Studies: Translating....390
  Courses in German....574
  Courses in Translating and Translation Studies....734
Global Business....127
  MBA with Concentration in Global Business....117
  MBA/Grad Certificate in Global Business Strategy Dual Degree....127
  M.S. in Economics/M.Sc. in Economics & Business Admin Dual Degree....127
  M.S. in Mathematical Finance/L.M. in Banking & Finance Dual Degree....128
  M.S. in Mathematical Finance/Master's in Int'l Business Dual Degree....128
Glossary....809
Government, Graduate & Professional Student....38
Grade Point Average (GPA)....62
Grading....60
Graduate Certificate Programs....8, 36
  Application Requirements....41
  Program Requirements....78
Graduate Council....36
Graduate Faculty....36, 737
Graduate Life, Center for....37
Graduate Life & Learning Courses (GRAD)....575
Graduate Management Admission Test (GMAT)....43
Graduate Programs....8, 36
Graduate Program Directors....36
Graduate Record Examination (GRE)....43
Graduate School, The....35
  Admission to....39
Graduate Student Life....37
Graduate Student Organizations....38
Graduate Student Orientation....37
Graduation Rate Disclosure Statement....16
Grants *(see Financial Aid)*

H

Health Administration....291
  Master of Health Administration....291
  MHA/MBA Dual Degree....120
  MHA/M.S. Health Informatics & Analytics Dual....292
  Courses in Health Administration....581
Health and Human Services, College of....283
Health Informatics and Analytics....446
  M.S. in Health Informatics and Analytics....446
  MHA/M.S. Health Informatics & Analytics Dual....292
  MPH/M.S. Health Informatics & Analytics Dual....319
  Grad Certificate in Health Informatics & Analytics....448
  Courses in Health Informatics and Analytics....583
Health Insurance, Student....44
Health Psychology....378
  Ph.D. in Health Psychology....378
  Courses in Health Psychology....595
Health Requirements for Admission....44
Health Services Research....293
  Ph.D. in Health Services Research....293
  Courses in Health Services Research....597
History....383
  M.A. in History....383
  Courses in History....588
History of UNC Charlotte....15
History of University of North Carolina....14
Housing, Cost of....86

I

ID Cards *(see 49er Card)*
Illegal Drugs and Alcohol Abuse 49
Immunization Requirements 44
Information Technology *(see Software and Information Systems)*
Infrastructure and Environmental Systems 270
  Ph.D. in Infrastructure/Environmental Systems 270
  Courses Infrastructure/Environmental Systems 599
Institutional Integrity, Division of 17
Instructional Coaching, Graduate Certificate 213
Inter-Institutional Registration 55
International Business *(see Global Business)*
International English Language Testing System 43
International Student Admission Requirements 43
Interpreting *(see Languages and Culture Studies)*

J

Japanese *(see also Languages and Culture Studies)*
  Graduate Certificate in Languages and Culture Studies: Translating 390
  Courses in Translating and Translation Studies 734

K

Kinesiology 285
  M.S. in Kinesiology 285
  Courses in Kinesiology 624

L

Languages and Culture Studies *(see also Foreign Language Education)* 386
  M.A. in Spanish 386
  Graduate Certificate in Languages and Culture Studies: Business Languages 388
  Graduate Certificate in Languages and Culture Studies: Translating 390
  Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies 391
  Courses in French 561
  Courses in German 574
  Courses in Languages and Culture Studies 626
  Courses in Spanish 721
  Courses in Interpreting 601
  Courses in Translation and Translation Studies 734
Latin American Studies 393
  M.A. in Latin American Studies 393
  Courses in Latin American Studies 626
Leave of Absence 55
Learning, Design, and Technology 218
  Ed.D. in Educational Leadership 197
  M.Ed. in Learning, Design, and Technology 218
  Grad Cert in Learning, Design, and Technology 220
  Courses in Learning, Design, and Technology 536
Liberal Arts & Sciences, College of 324
Liberal Studies 396
  M.A. in Liberal Studies 396
  Courses in Liberal Studies 627
Linguistics *(see English)*
Loans *(see Financial Aid)*

M

Management 129
  M.S. in Management 129
  Courses in Management 668
Map, Campus 831
Mascot 34
Master's Degree Programs 8, 36
  Accelerated Master's Programs 54
  Application Requirements 41
  Dual Master's Degrees 57
  Program Requirements 66
Mathematical Finance 131
  M.S. in Mathematical Finance 131
  M.S. in Mathematical Finance Dual Degrees 128, 133
  Courses in Mathematical Finance 559
Mathematics and Statistics 397
  Ph.D. in Applied Mathematics 397
  Ph.D. in Curriculum/Instruction - Math Education Concentration 179
  M.S. in Mathematics 400
  Courses in Mathematics 629
  Courses in Mathematics Education 628
  Courses in Operations Research 684
  Courses in Statistics 730
Mechanical Engineering 275
  Ph.D. in Mechanical Engineering 275
  M.S. in Mechanical Engineering 278
  Grad Certificate in Precision Metrology 281
  Courses in Mechanical Engineering 647
Middle Grades and Secondary Education *(see Curriculum and Instruction)*
Miller Analogies Test (MAT) 43
Mission Statement, University 16
Music 106
  Graduate Certificate in Vocal Pedagogy 106
  Courses in Music and Music Performance 672

N

Nanoscale Science 407
  Ph.D. in Nanoscale Science 407
  Courses in Nanoscale Science 673
New This Year 6
Noble Niner Code 51
Non-Degree Programs 8, 36
  Application Requirements 42
Nondiscrimination 16
Nonprofit Management *(see Public Administration)*

Nursing 297
Doctor of Nursing Practice (DNP)
Post-Master's 297
Nurse Anesthesia Across the Lifespan 299
M.S.N. 301
Adult Psychiatric Mental Health 307
Adult-Gerontology Acute Care Nurse Pract 304
Community/Public Health Nursing 311
Family Nurse Practitioner Across Lifespan 306
Nurse Administration 309
Nurse Anesthesia Across the Lifespan 303
Nurse Educator 310
Post-Master's/Graduate Certificate
Adult-Gerontology Acute Care Nurse Pract 305
Applied Nursing Informatics 308
Family Nurse Practitioner Across Lifespan 307
Nurse Administration 309
Nurse Educator 311
Courses in Nursing 681
Courses in Nurse Anesthesia 675
Courses in Nursing Practice DNP 677
Courses in Mental Health Nursing 678
Courses in Nurse Practitioning 679

O

Operations Management
Courses in Operations Management 684
Operations Research *(see Mathematics & Statistics)*
Optical Science and Engineering 410
Ph.D. in Optical Science and Engineering 410
M.S. in Optical Science and Engineering 413
Courses in Optical Science and Engineering 685
Organizational Science 416
Ph.D. in Organizational Science 416
Courses in Organizational Science 691
Organizations, Student *(see Graduate Student Org)*
Orientation, New Graduate Student 37

P

Parking Fees and Violations 87
Payment of Tuition and Fees 89
Ph.D. Degree Requirements 68
Philosophy *(see Ethics and Applied Philosophy)*
Physics 418
M.S. in Applied Physics 418
Courses in Physics 695
Plagiarism 48
Play Therapy *(see Counseling)*
Policies and Disclaimers, Catalog 7
Post-Baccalaureate (Non-Degree) Programs 8, 36
Application Requirements 42
Prerequisites, Course 452
Prerequisites and Permits 53
Privacy *(see Family Educational Rights &…)*
Programs, Degree and Non-Degree 8, 36
Change of 56
Provost 4, 737
Psychology 420
M.A. in Psychology 420
M.A. in Industrial/Organizational Psychology 422
Courses in Psychology 702
Public Administration 425
Master of Public Administration 425
Grad Certificate in Emergency Management 430
Grad Certificate in Nonprofit Management 430
Grad Certificate in Public Budgeting/Finance 431
Grad Certificate in Urban Mgmt & Policy 432
Courses in Public Administration 665
Public Budgeting and Finance *(see Public Administration)*
Public Health Sciences 312
Ph.D. in Public Health Sciences 312
Master of Public Health 315
MPH/M.A. in Anthropology Dual Degree 318
MPH/M.S. Health Informatics & Analytics Dual 319
Courses in Public Health 590
Public Policy 433
Ph.D. in Public Policy 433
Grad Cert in Public Policy Research & Analysis 437
Courses in Public Policy 697

R

Reader's Guide to the Catalog 6
Reading Education 222
Ph.D. in Curriculum and Instruction - Literacy Education Concentration 179
M.Ed. in Reading Education 222
Graduate Certificate in Adv Literacy Instruction and Intervention 223
Courses in Reading, Language, Literacy 707
Readmission *(See Admission to…)*
Real Estate and Development 135
M.S. in Real Estate 135
M.S. in Real Estate/MBA Dual Degree 136
Grad Certificate in Real Estate/Development 137
Courses in Real Estate 669
Records and Transcripts 79
Privacy of *(see Family Educational Rights &…)*
Refunds 90
Registration 53
Deadlines 53
Religious Studies 439
M.A. in Religious Studies 439
Courses in Religious Studies 709
Repeating Graduate Courses 62
Residence Status For Tuition Purposes 85
Respiratory Care
M.S. in Respiratory Care 288
Grad Cert in Respiratory Care Clinical Concepts 289
Grad Certificate in Respiratory Care Leadership 290
Courses in Respiratory Care 711

Russian *(see also Languages and Culture Studies)*
Graduate Certificate in Languages and Culture Studies: Translating 390
Courses in Translating and Translation Studies 734

S

Scholarships 89
School Administration *(see also Educational Leadership)*
Master of School Administration 202
Post-Master's Certificate in School Admin 203
Courses in School Administration 454
Second Degree, Earning a 57
Secondary Education *(see Curriculum and Instruction)*
Smoking on University Property 50
Social Work 320
Master of Social Work 320
Courses in Social Work 717
Sociology 440
M.A. in Sociology 440
Courses in Sociology 715
Software and Information Systems 155
M.S. in Cybersecurity 155
M.S. in Information Technology 157
Master of Arch & M.S. in IT Dual Degree 102
Certificate in Human-Computer Interaction 160
Certificate in Information Security & Privacy 161
Certificate in Management of Info Technology 161
Certificate in Network Security 162
Certificate in Secure Software Development 163
Certificate in Software Development 163
Courses in Software and Information Systems 614
Spanish *(see also Foreign Language Education and Languages & Culture Studies)*
M.A. in Spanish 386
Graduate Certificate in Languages and Culture Studies: Business Languages 388
Graduate Certificate in Languages and Culture Studies: Translating 390
Graduate Certificate in Languages and Culture Studies: Translation and Interpreting Studies 391
Courses in Spanish 721
Courses in Interpreting 601
Courses in Translating and Translation Studies 734
Special Education 224
Ph.D. in Special Education 224
M.Ed. in Special Education & Child Development 226
M.A.T. in Special Education 229
Graduate Certificate in Special Education 231
Graduate Certificate in Academically or Intellectually Gifted 233
Grad Certificate/Autism Spectrum Disorders 233
Courses in Special Education 722
Statistics *(see Mathematics)*
Student Affairs, Division of 17
Student Conduct 47
Student Government *(see Government)*
Student ID *(see 49er Card)*
Student Organizations 38
Student Life *(see Graduate Student Life)*
Student Responsibility 7, 48
Suspension *(see Academic or Disciplinary Suspension)*

T

Teaching English as a Second Language 234
Ph.D. in Curriculum and Instruction - Teaching English as Second Language Concentration 179
M.A.T. in Teaching English as Second Language 234
Graduate Certificate in TESL 236
Courses in Teaching English as Second Language 733
Termination, Academic 63
Termination of Enrollment 58
Terminology *(see Glossary)*
Test Information 43
Transcripts 79
Transfer Credit 56
Translating/Translation Studies *(see Languages and Culture Studies)*
Tuition and Fees 84
Payment 89
Refunds 90

U

University Advancement, Division of 17
University and College Teaching
Post-Master's Cert in Univ & College Teaching 204
University Logo 32
University Mission Statement 16
University of North Carolina History 14
University of North Carolina at Charlotte History 15
University Seal 32
University Structure 17
University Vision and Values 16
Uptown Campus *(see Center City)*
Urban Design *(see Architecture)*
Urban Education 237
Ph.D. in Curriculum and Instruction - Urban Education Concentration 179
M.Ed. in Urban Education 237
Graduate Certificate in Anti-Racism 238
Urban Management & Policy *(see Public Administration)*

V

Vision and Values, University 16
Vocal Pedagogy, Graduate Certificate in *(see Music)*

W

Withdrawal from a Course/University 58
Deadlines 53
Grade of W, WE 61
Non-Compliance/Immunization Requirements 44

Women's and Gender Studies *(see Gender, Sexuality, and Women's Studies)*
Workplace Competencies
Graduate Certificate in Workplace Competencies.....45
Courses in Graduate Life and Learning.....575

UNIVERSITY OF NORTH CAROLINA CHARLOTTE

Campus Map

Prepared by:
Facilities Information Systems
(704) 687-8622
www.charlotte.edu

Updated: 10/1/2021

Academic Buildings

4	Atkins	9	Garinger
16	Barnard	58	Grigg Hall
17	Belk Gym	87	Johnson Band Center
68	Bioinformatics	62	Kulwicki Laboratory
38	Burson	02	Macy
42	Cameron Hall	20	McEniry
52	Cato College of Education	18	Memorial Hall
85	Charlotte Engineering Early College	75	Motorsports Research
63	College of Health & Human Services	80	PORTAL
32	Colvard	51	Robinson Hall
8	Denny	19	Rowe
57	Duke Centennial Hall	97	Science Building
72	EPIC	12	Smith
45	Fretwell	41	Storrs
35	Friday	10	Winningham
		56	Woodward

Services - Places of Interest

General		***Administration***		***Places of Interest***	
39	Aux Services Building	48	Cato Hall - Graduate Admissions	54	Bissell House - Chancellor's Residence
46	Barnhardt - Student Activity Center - Halton Arena	535	Cedar Hall	71	Foundation
31	Cafeteria Activities Building	5	Cone University Center - Niner Central - Billing and Payments - Financial Aid - Registration/Transcripts	86	Foundation Annex
55B	Campus Police	95	Gage Undergraduate Admissions	77	Halton-Wagner Tennis Complex
5	Cone University Center	536	Hickory Hall	64	Harris Alumni Center
55A	Facilities Management	1	Kennedy	88	Hauser Alumni Pavilion
92	Facility Operations & Parking Services	11	King	44	Irwin Belk Track & Field
67	Hayes Baseball Stadium	36	Reese	6001	Jamil Niner Student Pantry
29	Housing & Res Life	537	Sycamore Hall	15	Niner House
37	McMillan Greenhouse	***Dining Services***		74	NRFC Fieldhouse
49	Miltimore-Wallis Center	5	Cone University Center	93	Receiving & Stores
91	Price Counseling Center	69	Popp Martin Student Union	79	Richardson Stadium
65	Student Health Center	80	PORTAL	78	Rose Football Center
4A	University Career Center	34	Prospector	6004	UNC Charlotte Marriott Hotel & Conference Center
96	University Recreation Center	82	South Village Crossing	43	Wells Fargo Fieldhouse

Access the Interactive Campus Map

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Campus Housing

562	Belk Hall	561	Miltimore Hall
543	Elm Hall	540	Oak Hall
560	Greek Village	541	Pine Hall
538	Hawthorn Hall	502	Sanford Hall
504	Holshouser Hall	503	Scott Hall
563	Hunt Hall	545	Wallis Hall
565	Laurel Hall	544	Witherspoon Hall
566	Levine Hall		
546	Lynch Hall		
542	Maple Hall		
564	Martin Village		

Parking Areas

Faculty & Staff (F/S)	Commuter & F/S	Visitor Parking
Lot 11	Lot 4A	***Pay on Foot Stations:***
Lot 15*	Lot 5 & 5A	Cone Deck 2** - Rooftop
Lot 29 & 29A	Lot 7 & 7A	CRI Deck 1**
CAB Lot	Lot 12	East Deck 1
Cone Deck 1 & 2*	Lot 14	South Village Deck** - Level 3
CRI 3*	Lot 23	Union Deck** - Levels 4 & 6
East Deck 1*	Lot 26	
SAC N Lot	CRI 2	
Union Deck Levels 4-6*	East Deck 2 & 3	
Resident & F/S	Union Deck	
Lot 8 & 8A	West Deck	
Lot 13	**Resident Commuter, & F/S**	***Metered:***
Lot 16	CRI Deck 1	Lot 4
Lot 20	Lot 6	Lot 13
Lot 21	Lot 25	Lot 16
RDH Lot	Lot 27	Lot 20
Disability Accessible	Lot 101	Lot 21
Lot 16A, CRI Lot 3A	South Village Deck	Lot 28**
Lot 23A, CRI Lot 4A	North Deck	Lot 30**
Lot 28, CRI Lot 5A	**For Parking Info Visit pats.charlotte.edu**	Greek Village Lot
Belk ADA Lot, North Deck		Robinson Hall Lot
CRI Lot 1 & 1A, SAC HC Lot		
CRI Lot 2A		

* F/S Premium Lot

** ADA Visitor Parking

ADA Accessible Parking
Metered Parking
Visitor Parking
Light Rail Stations

0 500 1,000 2,000 Feet