

THE SCHOOL OF GRADUATE STUDIES

GRADUATE CATALOG

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GRADUATE PROGRAMS

2005 – 2007

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GENERAL INFORMATION

North Carolina Agricultural and Technical State University

HISTORICAL STATEMENT

Today, one of the nation's leading Historically Black Universities and Colleges (HBCU), North Carolina Agricultural and Technical State University is classified as a Carnegie doctoral/research intensive university that is recognized as the top producing university for African American engineers and technologists. The University's programs have numerous accreditations including the first nationally accredited AACSB accounting program in the nation among HBCUs. The university's history as one of only eighteen HBCUs 1890 land-grant universities is well reflected in agriculture, animal science, environmental science, engineering, and technology programs, and a growing student enrollment is a further reflection of the demands for the North Carolina A&T's programs in education, nursing, and arts and sciences. North Carolina A&T also has a rich civil rights legacy, and its students, especially the Greensboro Four who are credited with beginning the movement, played a prominent role in the sit-ins of the 1960s.

Today's university has changed a great deal from the Agricultural and Mechanical College for the "Colored Race" established by an act of the General Assembly of North Carolina ratified on March 9, 1891. The College actually began operation during the school year of 1890-91, before the passage of the state law creating it.

The scope of degree programs has been expanded to meet new demands. The first graduate degree was approved when the General Assembly authorized the institution to grant the Master of Science degree in education and certain other fields in 1939. The first master's degree was awarded in 1941.

In 1957 the General Assembly repealed previous acts describing the purpose of the College and redefined its purpose "to teach the Agricultural and Technical Arts and Sciences" and added a heavy emphasis to the strengthening its efforts to train "teachers, supervisors, and administrators for the public schools of the State" especially preparing them to earn the Master's degree.

North Carolina's General Assembly voted to elevate the College to the status of a Regional University effective July 1, 1967. On October 30, 1971, the General Assembly ratified an Act to consolidate the Institutions of Higher Learning in North Carolina. Under the provisions of this Act, North Carolina Agricultural and Technical State University became a constituent institution of The University of North Carolina effective July 1, 1972.

Nine presidents/chancellors have served the Institution since it was founded in 1891. They are as follows: Dr. J. O. Crosby (1892-1896), Dr. James B. Dudley (1896-1925), Dr. F.D. Bluford (1925-1955), Dr. Warmoth T. Gibbs (1956-1960), Dr. Samuel DeWitt Proctor (1960-1964), Dr. Lewis C. Dowdy (1964-1980), Dr. Cleon F. Thompson (Interim Chancellor – 1980-1981), Dr. Edward B. Fort (1981-1999), and Dr. James C. Renick (1999-Present).

MISSION, PURPOSE AND GOALS OF THE UNIVERSITY

Mission Statement

North Carolina Agricultural and Technical State University is a public, doctoral/research intensive, land-grant university committed to fulfilling its fundamental purposes through exemplary undergraduate and graduate instruction, scholarly and creative research, and effective public service. The university offers degree programs at the baccalaureate, master's and doctoral levels with emphasis on agriculture, engineering, science, technology, literature and other academic areas. As one of North Carolina's three engineering colleges, the university offers Ph.D. programs in engineering. Basic and applied research is conducted by faculty in university centers of excellence, in interinstitutional relationships, and through significant involvement with several public and private agencies. The university also conducts major research through engineering, transportation, and its extension programs in agriculture.

North Carolina Agricultural and Technical State University aspires to be the premier interdisciplinary-centered university in America that builds on its comparative advantages in engineering, technology, and business; a strong civil rights legacy; and status as an 1890 land-grant institution. The challenges of preparing our students to meet the complex needs of the global society necessitate that these exemplary and relevant educational experiences are inherently global in nature and interdisciplinary in focus. The commitment to excellence and the unique NCA&TSU legacy of nurturing the individual student remain strong.

The University's evolution toward interdisciplinarity responds to societal and intellectual issues that require new solutions. Cross-functional teams with expertise from a variety of disciplines and perspectives are the best hope for the solution of complex modern challenges. As new problem-solving methods are needed, new disciplines are created at the intersection of old ones. Students are enthusiastic about courses that link learning to contemporary issues. An interdisciplinary education provides students with not only essential knowledge, but also connections across the disciplines, and finally, the ability to apply knowledge to life beyond the campus.

Interdisciplinary studies build upon disciplinary excellence while inspiring new possibilities beyond the strengths of traditional fields of study. This model provides a focus for curriculum innovation, fosters communication across disciplines, and promotes partnerships with public and private entities. This university creates a learning environment in which opportunities to build solutions are based on expertise in more than one discipline. Teaching focuses more on the ability to organize, assess, apply, and create interdisciplinary knowledge rather than the transmission of existing knowledge to students.

The teaching and learning process involves not only a commitment to knowledge and research, but also appreciates the influences of diverse thoughts, values, processes, resources, and structures as it seeks to organize and plan lifelong learning experiences. High expectations are supported by an infrastructure that facilitates the opportunity for constituents within the University to achieve and excel individually and collectively. Opportunities for learning are enhanced by varied methods of instruction, 24-hour availability, and through partnerships that are collaborative and cooperative.

To be productive citizens of the 21st century, our students must be globally informed. Thus, current efforts to globalize the curriculum will continue. In addition, students will have the opportunity to enhance their undergraduate education by taking part in overseas study, internships, or service learning experiences. Some may even earn a certificate in international studies. Likewise, international partnerships enhance interdisciplinary efforts and provide new opportunities for faculty and students to participate in and contribute to global change. The University exists for a society that is committed to research, knowledge and service to humankind. The physical space for learning is not to be limited to a specific site, but deliverable in a variety of locations with a multiplicity of available resources.

The interdisciplinary-centered university envisions its role to serve the needs of individuals and groups who seek continuous opportunities for intellectual stimulation and growth. Utilizing the traditional disciplines and technological resources, this University fosters excellence in communication, enhances critical thinking, conducts research, and transmits new knowledge to a community that seeks to improve the quality of life for all in the 21st century.

To realize the promise of the interdisciplinary-centered university, North Carolina A&T must initiate and nurture strategic partnerships, while concurrently enhancing and diversifying its resource base.

VISION

Building upon a solid foundation in academic programs, the faculty, staff and students endorsed the FUTURES strategic vision toward an interdisciplinary university. The adoption of the vision statement and a set of five goals are aimed at enhancing the culture of high standards in all programs and facilities and for all stakeholders --- students, faculty, staff, alumni, community, public and private sector friends of the University.

North Carolina Agricultural and Technical State University is a learner-centered community that develops and preserves intellectual capital through interdisciplinary learning, discovery, engagement, and operational excellence.

Goal One: Establish and ensure an interdisciplinary focus for North Carolina A&T that mandates overall high quality, continued competitiveness, and effective involvement of global strategic partners in marketing and delivery of programs and operations.

Goal Two: Deliver visionary and distinctive interdisciplinary learning, discovery, and engagement that include collaborations and partnerships as part of the learning experience.

Goal Three: Foster a responsive learning environment that utilizes an efficiently integrated administrative support system for high quality programs, research and collegial interactions, and effectively disseminates consistent information to University stakeholders.

Goal Four: Provides superior: readily available student services and programs that recognize and respond to diverse student needs.

Goal Five: Enhance and diversify the University's resource base through effective fund-raising, entrepreneurial initiatives, enhanced facilities, and sponsored research programs.

NONDISCRIMINATION POLICY AND INTEGRATION STATEMENT

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, gender, age, or disability. Moreover, NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of white students.

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY supports the protections available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, and Executive Order 11246.

AGGIE PRIDE COMPACT

Achieving Great Goals In Everything – Producing Renowned Individuals Dedicated To Excellence

The essence of *Aggie Pride* is manifested in standards depicting what it truly means to be a responsible member of The North Carolina Agricultural and Technical State University Family. These standards provide the impetus and inspiration, which motivate students, faculty, staff, administrators, and trustees alike in their perpetual commitment to excellence. North Carolina Agricultural and Technical State University has a unique legacy of nurturing individual students to realize their fullest potential.

North Carolina Agricultural and Technical State University is a learner-centered community

that develops and preserves intellectual capital through interdisciplinary learning, discovery, engagement, and operational excellence. As members of the university community, all stakeholders share a pervasive sense of trust, pride, and allegiance in ensuring the preeminent status of North Carolina Agricultural and Technical State University in a global society. The following standards define the essence of **Aggie Pride**:

Aggie Pride is consistently communicating and behaving in a manner that displays integrity, honesty, sound character, and virtuous ethics. (Values)

Aggie Pride is expecting and achieving success and setting high standards in all personal and professional ventures. (Achievement)

Aggie Pride is taking a personal stand to positively affect the continuous growth, development and enhancement of the University at large. (Commitment)

Aggie Pride is accepting and demonstrating a steadfast commitment to learning by taking responsibility through personal and professional development. (Self-determination)

Aggie Pride is striving to significantly influence the development of individuals of all ages within and beyond our community to become lifelong learners. (Lifelong Learning)

Aggie Pride is exhibiting a positive and willing attitude to unselfishly serve and to pledge ones talents and gifts for the betterment of North Carolina Agricultural and Technical State University and the larger world community. (Service)

Aggie Pride is contributing to the establishment and maintenance of a safe, clean, and aesthetically appealing campus with a favorable ecosystem. (Building Community)

Aggie Pride is exhibiting a relentless desire and commitment to treat all individuals with a high level of appreciation and respect and to expect the same in return. (Respect)

Aggie Pride is effectively representing the University by utilizing personal knowledge, skills, and resources. (Confidence)

Aggie Pride builds on the past, maintains the present, and accepts the challenges of the future while providing our personal financial resources to preserve our legacy and ensure our future. (Legacy)

Therefore, as a member of the North Carolina Agricultural and Technical State University family, I unconditionally accept the obligation entrusted to me to live my life according to the standards set forth in this Compact. By my words and actions, I commit to Aggie Pride and the pursuit of excellence for myself and for my University.

CODE OF STUDENT CONDUCT

Students enrolled at North Carolina Agricultural and Technical State University are expected to conduct themselves properly at all times. They are expected to observe standards of behavior and integrity that will reflect favorably upon themselves, their families, and the University. They are expected to abide by the laws of the city, state, and nation, and by all rules and regulations of the University.

Accordingly, any student who demonstrates an unwillingness to adjust to the rules and regulations that are prescribed or that may be prescribed to govern the student body will be placed on probation, suspended, or expelled from the institution.

A student may forfeit the privilege of working for the University when, for any reason, he or she is placed on probation because of misconduct. The policies and procedures governing students' conduct are located in the Student Handbook which is distributed annually.

ADMINISTRATION, North Carolina A&T State University

James C. Renick, *Chancellor*

Carolyn W. Meyers, *Provost and Vice Chancellor for Academic Affairs*

Willie T. Ellis, Jr., *Vice Chancellor for Business and Finance*

Roselle L. Wilson, *Interim Vice Chancellor for Student Affairs*

David W. Hoard, *Vice Chancellor for Development and University Relations*

Narayanaswamy Radhakrishnan, *Vice Chancellor for Research and Economic Development*

Rodney E. Harrigan, *Vice Chancellor for Information Technology and Telecommunications/CIO*

Colleen P. Grotzky, *Executive Assistant to the Chancellor*

Camille Kluttz-Leach, *Special Assistant to the Chancellor for Legal Affairs*

DEANS OF COLLEGES AND SCHOOLS

Alton Thompson, *Dean, School of Agriculture and Environmental Sciences*

Michael A. Plater, *Dean, College of Arts and Sciences*

Quiester Craig, *Dean, School of Business and Economics*

Lelia Vickers, *Dean, School of Education*

Joseph Monroe, *Dean, College of Engineering*

Kenneth H. Murray, *Dean, School of Graduate Studies*

Patricia Price-Lea, *Dean, School of Nursing*
Elazer Barnette, *Dean, School of Technology*

COLLEGES, SCHOOLS, AND DIVISIONS OF NORTH CAROLINA AGRICULTURALAND TECHNICAL STATE UNIVERSITY

North Carolina Agricultural and Technical State University includes the following colleges, schools, and divisions: The School of Agriculture and Environmental Sciences, The College of Arts and Sciences, The School of Business and Economics, The School of Education, The School of Technology, The College of Engineering, The School of Nursing, School of Graduate Studies, and The Division of Continuing Education and Summer School.

ACCREDITATION AND INSTITUTIONAL MEMBERSHIPS

North Carolina Agricultural and Technical State University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, Georgia 30033-4097: Telephone number 404-679-4501) to award the bachelor's, master's, and doctoral degrees.

The program of Industrial Technology is accredited by the National Association of Industrial Technology.

The Media Program is accredited by the Association of Educational Communications and Technology.

The Teacher Education Programs are accredited by the National Council for Accreditation of Teacher Education.

The Department of Chemistry is accredited by the American Chemical Society.

The Social Work Programs of the Department of Sociology and Social Work are accredited by the Council on Social Work Education.

The Department of Home Economics is accredited by The American Home Economics Association.

The University holds institutional membership in the following associations:

American Association of Colleges for Teacher Education
American Association of Collegiate Registrars and Admission Officers
National Association of State Universities and Land Grant Colleges
American College of Public Relations Association
American Council for Construction Education
Associated Schools of Construction
American Council on Education
American Public Welfare Association
American Library Association
Association of American Colleges
Association of Collegiate Deans and Registrars
Association of Collegiate Schools of Architecture
American Personnel and Guidance Association
The Council of Graduate Schools
National Association of Industrial Technology, International Association of Technology Education
National Association of Student Personnel Association
Association of College Unions International
National Association of College and University Food Service
National Commission on Accrediting
National Institutional Teacher Placement Association
North Carolina Association of Colleges and Universities
North Carolina Library Association
National Association of College and University Business Officers
National Association of Business Teacher Education
American Personnel and Guidance Association
National Association of Industrial Technology, International Association of Technology Education, and the American Driver and Traffic Safety Education Association
National Association of Student Personnel Administrators
Association of College Unions International
National Association of College and University Food Service

National Commission on Accrediting
National Institutional Teacher Placement Association
Southeastern Library Association
Graduates of the University are eligible for membership in the American Association of
University Women.

ACADEMIC CALENDAR

NOTE: This calendar is subject to periodic revision. Please check with the University Registrar to determine if changes have been made, or visit our website at www.ncat.edu.

**North Carolina A&T State University
2005-2006 Academic Calendar**

FALL SEMESTER 2005

SPRING 2006

August 2 - Tuesday	Tuition, Fees, Room and Board due	January 3, 2006	New Year's Resolution Party
August 11 - Thursday	Faculty Institute – Faculty Report	January 5 - Thursday	Residence Halls open 9:00 a.m.-3:00 p.m. New Students In Residence Halls Report Registration for Continuing Students Faculty Report
August 12 - Friday	Graduate Teaching Assistant Training	January 5 – 6 Thurs. and Friday	Orientation, Advisement and Registration for New Students (Tuition, Fees, Room and Board due 8:30 a.m. – 2:00 p.m.)
August 12 – 13 Friday and Saturday	New Students Report for Fall (Residence Halls open 9:00 a.m. – 3:00 p.m.)	January 5 – Thursday	Graduate Student Orientation
August 14 – Sunday	CONTINUING STUDENTS REPORT (Residence Halls open 9:00 a.m. – 3:00 p.m.)	January 6 – Friday	Graduate Teaching Assistants Training
August 14 – 16 Sunday – Tuesday	Welcome Program for New Students and Transfer Students	January 9 – Monday	CLASSES BEGIN LATE REGISTRATION BEGINS (\$20.00 late fee)
August 15 - Monday	Registration for Continuing Students Graduate Student Orientation	January 13 – Friday	Deadline For PBS Certification Admissions Application
August 17 – Wednesday	CLASSES BEGIN LATE REGISTRATION BEGINS (\$20.00 late fee)	January 13 – Friday	LAST DAY TO ADD or AUDIT A COURSE LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT LAST DAY TO APPLY FOR SPRING GRADUATION (Both Undergraduate and Graduate Students) LAST DAY TO RECEIVE BOOK ALLOWANCE LATE REGISTRATION ENDS Last Day to Submit Tuition Waivers
August 19 – Friday	Deadline for PBS Certification Admission Applications	January 16 – Monday	UNIVERSITY HOLIDAY (Martin Luther King, Jr.)
August 24 - Wednesday	LAST DAY TO ADD or AUDIT A COURSE LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT LAST DAY TO APPLY FOR FALL GRADUATION LATE REGISTRATION ENDS (includes tuition waivers) Last Day to Submit Tuition Waivers LAST DAY TO RECEIVE BOOK ALLOWANCE	January 27 - Friday	Ronald E. McNair Memorial Day (classes are not cancelled)

September 5 – Monday	UNIVERSITY HOLIDAY (Labor Day)	February 1 – Wednesday	Grade Evaluation For Student Athletes
September 16 – Friday	Grade Evaluation for Student Athletes	February 17 – Friday	Deadline to Remove Incomplete(s) received Fall 2005
September 16 – 18 Friday – Sunday	NC A&T SU Family Weekend (NC A&T vs Hampton University)	February 28 – Tuesday	Deadline to apply for Certificate in Entrepreneurship <i>Deadline to apply for Waste Management Certificates</i>
September 26 – Monday	Deadline to remove Incomplete(s) received Spring and Summer 2005	March 2 – Thursday	Mid-term grades due
October 7 – Friday	Mid-Term Grades due	March 4 – Saturday	<i>Residence Halls close 1:00 p.m.</i>
October 13 – Thursday	Founder’s Day (Classes Suspended 10 am – 12 noon)	March 6-10 Mon. – Fri.	SPRING BREAK
October 15 – Saturday	Homecoming	March 10 – 14	Final Comprehensive Exam Week (Graduate Students)
October 17-18 Monday – Tuesday	FALL BREAK	March 12 – Sunday	Residence Halls re-open 9:00 a.m.
October TBA	Fall Open House for Transfer/Adult Students	March 23 – Thursday	HONOR’S CONVOCATION (Classes are suspended from 3 – 5:00 pm)
October 29 – Saturday	University Day	March 28 – Tuesday	LAST DAY TO DROP A COURSE WITHOUT GRADE EVALUATION
October 31 – November 4 Monday – Friday	Final Comprehensive Exam Week (Graduate Students)	April 1 –7 Saturday – Friday	Graduate Student Appreciation Week
October 28 – Friday	Deadline to apply for Waste Management Certificates Deadline to apply for Certificate in Entrepreneurship		
November 1 – Tuesday	Deadline for Graduate/Doctoral/International admission applications for Spring 2006	April 1 – Saturday	Deadline for Graduate Admission Applications for HDSV – Counseling Program for Fall 2006 Deadline for Graduate/Doctoral/International admission applications for Fall 2006
November 2 – Wednesday	Last Day to Drop a Course Without Course Evaluation	April 3	ADVISEMENT AND REGISTRATION For Fall 2006 Early Summer School Registration
November 4 – Friday	Last Day to Defend Thesis/Dissertation	April 7 – Friday	Last Day to Defend Thesis/Dissertation
November 7 – Monday	Defended and approved Theses/Dissertations Due in Graduate School Office	April 10 – Monday	Defended and Approved Thesis/Dissertation due in Graduate School Office
November 7 Monday - Friday	ADVISEMENT AND REGISTRATION for Spring 2006	April 11 – Tuesday	Last Day to Withdraw from the University without a Grade Evaluation
November 8 – Tuesday	LAST DAY TO WITHDRAW FROM THE UNIVERSITY WITHOUT GRADE EVALUATION	April 14 – Friday	University Holiday – Good Friday
November 11 – Friday	Grade evaluations for Student Athletes	April 18 – Tuesday	Grade Evaluation for Student Athletes

November 23 – Wednesday	<i>THANKSGIVING HOLIDAY begins at 7:00 a.m.</i>	April 28 – Friday	<i>Thesis/Dissertation print copies for binding due in Graduate School Office</i>
November 28 – Monday	THANKSGIVING HOLIDAY ends at 7:00 a.m. Thesis/Dissertation print copies for binding due in Graduate School Office	May 2 – Tuesday	CLASSES END
December 1 – Thursday	<i>Applications for Spring Semester Admission to the University Due</i>	May 3 – Wednesday	READING DAY
December 7 – Wednesday	CLASSES END	May 4 – 10 Thurs. – Weds.	FINAL EXAMS
December 8 – Thursday	<i>READING DAY</i>	May 11 – Thursday	Residence Halls Close for Non-graduating Students at 12:00 noon
December 9 - 15 Friday - Thursday	FINAL EXAMS	May 12 – Friday	Waste Management Certificate Ceremony Grades due by 3:00 p.m.
December 16 – Friday	Residence Halls close for Non-graduating Students at 12:00 noon Grades due by 3:00 p.m. Waste Management Certificate Ceremony	May 13 – Saturday	COMMENCEMENT Residence Halls close for graduating seniors at 7:00 p.m. Academic Year Ends
December 17 - Saturday	COMMENCEMENT Residence Halls close for graduating seniors at 7:00 p.m.	May 22 - Monday	First and Dual Summer Sessions begin
		June (TBA)	<i>Summer Open House – Transfer/Adult Students</i>
		June 8 - 9 (Thurs. – Fri.)	New Freshmen and Transfer Students Summer Orientation
		June 12 – 13 (Mon. – Tues.)	New Freshmen and Transfer Students Summer Orientation
		June 15 – 16 (Thurs. – Fri.)	New Freshmen and Transfer Students Summer Orientation
		June 21 – 22 (Weds. – Thurs.)	New Freshmen and Transfer Students Summer Orientation
		June 23 (Friday)	Commuter and Weekend Student Summer Orientation
		June 27 – 28 (Tues. – Weds.)	New Freshmen and Transfer Students Summer Orientation

Disclaimer: Please note that the academic calendar is subject to change. Please consult with the University regarding dates.

THE SCHOOL OF GRADUATE STUDIES

Graduate education at North Carolina Agricultural and Technical State University was authorized by the North Carolina State Legislature in 1939. The authorization provided for training in agriculture, technology, applied sciences, and other approved areas of study. An extension of the graduate program approved by the General Assembly of North Carolina in 1957 provided for enlargement of the curriculum to include teacher education, as well as such other programs of a professional or occupational nature as might be approved by the North Carolina Board of Higher Education.

On July 1, 1967, the Legislature of North Carolina approved regional university status for the institution and renamed it North Carolina Agricultural and Technical State University. The University awarded its first master's degree in 1941 to Woodland Ellroy Hall. Since that time, nearly 6,700 students have received this coveted degree of advanced studies. A significant number of these graduates have gone on to other universities to achieve the prestigious doctoral degree in their chosen disciplines. In recent years, a number of students who received their master's degree from A&T remained at A&T to earn a doctoral degree from A&T's College of Engineering.

The School of Graduate Studies has an integrated and intercultural faculty and student body and beckons students from all over the world. It coordinates and administers advanced course offerings in departments within the School of Agriculture and Environmental Sciences, the College of Arts and Sciences, The School of Business and Economics, the School of Education, the College of Engineering, and the School of Technology. The School of Graduate Studies offers advanced study for qualified individuals who wish to improve their competency for careers in professions related to agriculture, humanities, education, science, and technology. Such study of information, techniques, and skills is provided through curricula leading to the Master of Science, the Master of Arts, the Master of Education, Master of Social Work, Master of Science in Industrial Technology or the Doctor of Philosophy degree and through institutes and workshops designed for those who are not candidates for a higher degree.

North Carolina Agricultural and Technical State University heralds the new frontier of higher education with three new interdisciplinary graduate programs. The new interdisciplinary programs offered are a master of science in Computational Science and Engineering and two Ph.D. Programs, Energy and Environmental Studies and Leadership Studies. These merged disciplines offer students an unparalleled opportunity for specialization in the areas of leadership, economics, environment, engineering and technology. Students will undertake rigorous research and internships while enjoying a close interaction with scientists, engineers and professionals in other fields. The interdisciplinary programs present graduate students with the unique opportunity to draw expertise and resources from various disciplines across the university.

The School of Graduate Studies provides a foundation of knowledge and techniques for those who wish to continue their education in doctoral programs at other institutions or within this institution as it expands into the doctoral arena. While studying at this university, it is expected that graduate students (1) will acquire special competence in one or multiple fields of knowledge; (2) will further develop their ability to think independently and constructively; (3) will develop and demonstrate the ability to collect, organize, evaluate, create, and report facts that will enable them to make a scholarly contribution to knowledge about their discipline; and (4) will make new application and adaptation of existing knowledge so as to contribute to their professions and to humankind.

Eleven persons have served as dean of the School of Graduate Studies since its beginning in 1939. They are Dr. Wadaran L. Kennedy (1939-1951), Dr. Frederick A. Williams (1951-1961), Dr. George C. Royal (1961-1965), Mr. J. Niel Armstrong (1965-1966), Dr. Darwin Turner (1966-1969), Dr. Albert W. Spruill, (1970-1993), Dr. Meada Gibbs (1993-1996), Dr. Charles Williams (1996-1997), Dr. Melvin N. Johnson (1997), Dr. Thoyd Melton (1998-2000), and Dr. Kenneth H. Murray (2000-Present).

ORGANIZATION

School of Graduate Studies Council

The School of Graduate Studies Council is responsible for formulating all academic policies and regulations affecting graduate students, graduate courses, and graduate curricula. The council consists of faculty, students and administrative representatives from graduate programs. The Dean of the School of Graduate Studies serves as chairperson of the Council.

GRADUATE ADMISSION

Applications for admission must be accompanied by the following: two official transcripts from all colleges and universities previously attended including NCA&TSU; references from at least three people who know of the student's academic record and potential for graduate study; a non-refundable application fee of \$45; and, in most cases, an official statement of the student's Graduate Record Examination or other standardized test scores. Some departments may require a letter of intent. An application and reference forms may be obtained by visiting the Website at <http://www.ncat.edu/~gradsch/> or by writing or visiting North Carolina A&T State University, School of Graduate Studies, 120 Gibbs Hall, Greensboro, NC, 27411-3210. When completed, all application materials should be returned according to instructions. Students who choose not to enroll for the semester in which they are applying may request in writing to defer their application and supporting documents for up to **one year**. After one year, all documents will be shredded and prospective students are required to complete the application process again, including application fee.

Required Application Material

The admission process is designed to collect credentials that will help determine which applicants have the academic preparation, intellectual ability, experience, and motivation to undertake a rigorous program of study. The application materials for each prospective student receive individual attention and thorough review by the intended program committee. In addition to the application form and application fee, the following official documents must be submitted before an application can be considered complete and submitted for evaluation by the intended program. **All materials submitted as part of an application becomes a part of the University's official record and cannot be returned to the student, not can it be forwarded to a third party.**

Letters of Recommendation

Three letters of recommendation from persons qualified to evaluate your academic and professional qualifications are required. You should request recommendations from individuals who are familiar with your academic achievement and potential. If you have been out of school for a number of years and are unable to contact your professors, letters from other individuals who can address your achievement and potential will be accepted. Please carefully complete the top section of the enclosed letter of recommendation forms before giving it to the person you have selected to complete the evaluation. The recommendations should be returned to you in a sealed envelope. *Although it is extremely helpful if these letters are sent with the program material, recommendation letters can be mailed separately.* Please inform the person completing your recommendation of the appropriate application deadline so that they can submit the recommendation before the application deadline date. Note the "waiver of right to inspect" statement on these forms; you may or may not elect to sign the waiver. If you elect to sign the waiver, or do not respond at all, the contents of the reference will not be available for you to inspect. Inspection of the reference letter only refers to viewing the recommendation letter. **As stated above, all material submitted as part of an application becomes a part of the University's official record and cannot be returned to the student, nor can it be forwarded to a third party.**

Transcripts

Two official transcripts of all post-secondary (after high school) education, bearing the signature of the registrar and the seal of the institution, should be sent to the School of Graduate Studies in a sealed envelope. Transcripts that bear the statement "Issued to Student," or that do not arrive in sealed envelopes, are not considered official. The School of Graduate Studies prefers that applicants submit official transcripts with their application. However, if an institution's registrar will only send transcripts directly to another institution, the School of Graduate Studies will accept and process transcripts separately. *Do not send transcripts directly to the intended program.* To prevent delays in review of an application, you should request transcripts before mid-year grades are posted. However, you are still responsible for ensuring that a final transcript is received, showing award of the degree. Transcripts submitted

to the School of Graduate Studies become part of the permanent record and cannot be released to another institution, employer, or to the student.

Standardized Test Scores (GRE, GMAT, etc.)

Current (no more than five years old) standardized test scores, usually GRE General Test, are required for most programs.

The School of Graduate Studies' accreditation requires that official reports (reported directly from ETS) of all required standardized test scores be submitted as part of the application. While photocopies of score reports will be accepted for informal evaluation, an official agency report of all required scores must follow. GRE, GMAT, and MAT scores are reportable for a period of five years from the date of the exam. Test scores of students who apply and decide not to enroll in graduate studies at North Carolina A&T State University are maintained for one year.

Supplemental (Program-Specific) Application Material

Many programs require statements of purpose, supplemental applications, essays, portfolios, etc. Please check with the intended program regarding their requirements, before submitting your application. An application cannot be considered *complete* until all required material are submitted.

Because of processing requirements, an admission decision for fall semester cannot be guaranteed unless all credentials are received by **July 1**, for spring semester by **November 1**, and for summer sessions by **April 1**. International students should refer to the deadlines for international students.

International Students

International students are required to meet all of the above requirements in addition to those listed below. The application and all supporting documents should be filed as early as possible to allow sufficient time for processing by both the academic program and the Graduate School. The Graduate School encourages international students to submit the application and all supporting documents no later than **April 1** for Fall admission and by **September 1** for Spring admission. Applicants interested in Summer Sessions must contact the International Students and Scholars Office.

English Proficiency

Students whose native language is other than English, regardless of citizenship, must submit official TOEFL (Test of English as a Foreign Language) scores issued by the Educational Testing Service as evidence of ability to use English at a level of competence sufficient for graduate work. The minimum requirement for admission is a TOEFL score of 550 or better (213 computer-based score), with scores of 50 on at least two of the sections and no section score below 45. (The minimum score is subject to change; departments may establish a higher minimum requirement.) The TOEFL test date must be within 24 months of the application deadline date before the semester for which the application is being reviewed.

Academic International Transcripts

Official academic transcripts from all international universities are required to be submitted, along with a certified English translation and a course by course transcript evaluation completed and forwarded by an external agency directly to the School of Graduate Studies, 120 Gibbs Hall, North Carolina A&T State University, Greensboro, NC 27411. North Carolina A&T State University recognizes the following transcript evaluation agencies: Educational Credential Evaluators, Inc. (www.ece.org) and World Education Services (www.wes.org). Evaluations completed by other agencies may not be recognized and accepted by the School of Graduate Studies. Official academic transcripts must bear the signature of the registrar or other academic official, and the official seal of the issuing institution. Students must hold the degree of Bachelor of Arts or Bachelor of Science, or its equivalent, based on a four-year curriculum. Transcripts submitted to the School of Graduate Studies become part of the permanent record and cannot be released to another institution, employer, or to the student.

Financial Verification

The international applicant must also provide the University with verification that the required funds are available to support the proposed program of advanced study. Foreign nationals in the United States at the time application is made must also provide information

regarding their current visa status. The University provides special forms to be used by the applicant in supplying this information. For information concerning visa, United States immigration, or the Financial Certificate, contact the Office of International Students and Scholars at (336) 334-7551.

ADMISSION TO MASTER'S DEGREE PROGRAMS

The procedures followed in evaluating an applicant's potential for success in graduate work and the criteria used for admission decisions vary according to programs and colleges/schools and reflect an evaluation of the applicant's potential to engage in graduate work and the capability of the individual programs to accommodate additional students. Generally, requests for admission are considered by departmental admissions committees, which forward the departmental recommendations to the dean of Graduate Studies. Students denied admission to one academic program must re-apply for admissions to be considered by another academic department.

Students are admitted to full or provisional status in a specific degree program. Admission is granted for a specific semester or summer term. Any change in the admission date must be requested in writing and approved by the department and School of Graduate Studies. Once the academic requirements for that degree program have been completed, no further registration as a graduate student will be permitted unless admission to a new graduate classification has been formally approved.

Admission to Degree Programs

Applicants to a master's degree program for graduate study must have earned a bachelor's degree from a nationally accredited four-year college. Application forms must be submitted to the School of Graduate Studies with two official transcripts of all previous undergraduate and graduate studies, and three letters of recommendation. Applicants may be admitted to graduate studies unconditionally, provisionally, or as a non-degree seeking post-baccalaureate studies (PBS) student. Applicants are admitted without discrimination because of race, color, creed, or gender. Transcripts submitted to the School of Graduate Studies become part of the permanent record and cannot be released to another institution, employer, or to the student.

Unconditional Admission

To qualify for unconditional admission to a master's degree program for graduate study, an applicant must have earned an overall average of 2.6 on a 4 point system (or 1.6 on a 3 point system) in his/her undergraduate studies. Some programs require a 3.0 grade point average on a 4.0 scale; therefore, applicants should check appropriate sections of the *Graduate Catalog* to ascertain the minimum grade point average required. In addition, a student seeking a degree in Agricultural Education, Elementary Education, Technology Education, or Secondary Education must possess, or be qualified to possess, a Class A Teaching License in the area in which he/she wishes to concentrate. See certification exception for Vocational-Industrial Education (post-secondary/private industry).

Provisional Admission

An applicant may be admitted to the master's degree program for graduate study on a provisional basis if (1) the earned baccalaureate degree is from a non-accredited institution, (2) the record of undergraduate preparation reveals deficiencies that can be removed near the beginning of graduate study and/or (3) final documents are still needed. A student admitted provisionally may be required to pass examinations to demonstrate his/her knowledge in specified areas, to take specified undergraduate courses to improve his/her background, or to demonstrate his/her competence for graduate work by earning no grades below "B" in the first nine hours of graduate work at this institution.

Post-Baccalaureate Studies (PBS)

Students not seeking to be admitted to a graduate program at A&T may be allowed to take courses for self-improvement or for renewal of teaching certificate if said students meet the School of Graduate Studies entrance requirements. If a student subsequently wishes to pursue a degree program, he/she must complete the full admission process. The School of Graduate Studies reserves the right to refuse to accept towards a degree program credits which the candidate earned while enrolled as a PBS student; in no circumstances may the student apply towards a degree program more than twelve semester hours earned as a PBS student. In addition, some academic departments restrict their courses to degree-seeking students only.

ADMISSION TO DOCTORAL PROGRAMS

Applicants to doctoral programs in Electrical Engineering, Energy and Environmental Studies, Industrial and Systems Engineering, Leadership Studies and Mechanical Engineering must submit completed application forms with two official transcripts of previous undergraduate and graduate studies and an official copy of their GRE/GMAT test scores. Other admission criteria are outlined below under the following headings: unconditional admission and provisional admission. Transcripts submitted to the School of Graduate Studies become part of the permanent record and cannot be released to another institution, employer, or to the student.

Early application is encouraged, particularly if the applicant wishes to be considered for an assistantship.

Unconditional Admission

Unconditional admission is offered to applicants who satisfy all general School of Graduate Studies requirements. Applicants must have earned a Bachelors and Masters Degree in the appropriate discipline. In addition, they must have received a 3.5 grade point average in their Master's level work. Graduate Record Examination scores are required. Test of English as a Foreign Language (TOEFL) scores are required for international students.

Provisional Admission

Provisional admission is offered to applicants who meet all conditions except the 3.5 grade point average in the Master's degree. Provisional students must convert to unconditional admission on a timely basis by achieving a 3.5 average on graduate coursework when the ninth credit is completed.

JOINT DOCTORAL PROGRAM WITH INDIANA STATE UNIVERSITY

North Carolina A&T State University School of Technology and Indiana State University School of Technology offers a joint doctor of philosophy consortium degree program in Technology. The specializations, program requirements, and admission requirements are listed below.

Specializations are:

- Construction Management
- Digital Communications
- Human Resource Development and Training
- Manufacturing Systems
- Quality Systems

Program Requirements

The Ph.D. in Technology Management consists of a minimum of 90 hours of course work and research at the post-baccalaureate level. Included is course work in a general technology core, a research core, a technical specialization, an internship, a residency requirement, and a dissertation.

Admission Requirements

Admission to the program is based on students meeting the following standards. The qualitative standards identified below reflect the minimum necessary for admission but do not ensure admittance.

- Bachelor's degree from an accredited university with a minimum undergraduate grade point average of 3.0 on a 4.0 scale.
- Minimum graduate grade point average of 3.5 on a 4.0 scale.
- Graduate Record Examination minimum scores of 500 on the verbal, quantitative, and analytical general tests.
- Five letters of recommendation.
- Employer validation of 2000 hours of occupational experience related to a technical specialization.
- Written statement including reasons for selecting the program, specialization, and goals upon graduation.

- Completion and mailing of application to the School of Graduate Studies, Indiana State University or completion of the application on-line at www.indstate.edu/grad/applications.html.

GRADUATE PROGRAMS REQUIRING CLASS A LICENSURE AND LICENSURE ONLY

Students applying for graduate degree programs in agricultural education, elementary education, instructional technology, technology education, and secondary education programs are required to possess or be eligible to possess the Class A license. Eligibility for the Class M (graduate-level) licensure requires an individual to possess the initial Class A licensure.

Agricultural Education

Students pursuing the M.S. degree in agricultural education must satisfy requirements for the Class A licensure in agricultural education. Students who have earned some but not all undergraduate credits for agricultural education and students without the A license in the area of agricultural education should consult with the agricultural education coordinator or the chairperson in the Department of Agribusiness, Applied Economics and Agriscience Education to design a program of study that addresses requirements for the initial license. This program of study supplements the graduate requirements in this teaching specialty area. Students may be required to enroll in undergraduate courses in education and student teaching to fulfill licensure requirements.

Elementary Education

Students pursuing the M.A.Ed. degree in elementary education must satisfy requirements for the Class A licensure in elementary education before being admitted to the program.

Instructional Technology

Students interested in the M.S. degree in instructional technology and the 076 (Media Coordinator), 074 (Instructional Technology Specialist-Telecommunications) and 077 (Instructional Technology Specialist-Computers) licensure must possess an initial Class A teaching license. Individuals without this license must meet with the instructional technology coordinator or the chairperson in the Department of Curriculum and Instruction to design a Class A licensure program of study before being admitted to the program. University or completion of the application on-line at: www.indstate.edu/grad/applications.html.

Technology Education

Students pursuing the MS in Technology Education with a concentration in Technology Education, Teaching; Trade and Industrial Education, Teaching; or Workforce Development Director must satisfy the requirements for the Class A license in their area before being admitted to the program. They may be admitted as Post Baccalaureate Studies students to pursue completing licensure requirements.

PROFESSIONAL EDUCATION REQUIREMENTS FOR LICENSURE

Students who enter graduate study without the required credits in education courses and who are pursuing a teaching program in secondary education must complete a minimum of 24 semester hours which may include the following undergraduate/graduate level courses: CUIN 400, Psychological Foundations of Education; CUIN 619, Learning Theories; CUIN 625, Theory of American Public Education or CUIN 701; Philosophy of Education; CUIN 500, Principles and Curricula of Secondary Schools or CUIN 720, Curriculum Development; CUIN 624, Teaching Reading in the Secondary School; and CUIN 560, Observation and Student Teaching, or CUIN 559, Student Teaching in the Elementary School.

LICENSURE ONLY PROGRAMS

Students may be admitted to the School of Graduate Studies for licensure (certification) only. These persons are admitted for the sole purpose of satisfying North Carolina teaching licensure requirements. Individuals must possess an earned undergraduate degree and, upon acceptance for this purpose, confer with the respective area coordinator or department chairperson to design a program of study. Students pursuing licensure only must apply for admission to the Teacher Education Program prior to pursuing the student teaching requirement.

Information regarding the Teacher Education Program is available through the Office of the Dean, School of Education.

REGISTRATION AND RECORDS

It is each student's responsibility to be fully conversant with the academic regulations and requirements set forth in this Catalog and for revisions of same as posted on campus bulletin boards or released in other official publications of the University. Lack of knowledge of regulations and requirements does not excuse the student from complying with academic regulations and meeting the requirements.

A student's program of study must be approved by his/her advisor, his/her chairperson, and members of the faculty advisor committee in his/her major department at registration. Advisors will make every attempt to give effective guidance to students in academic matters and to refer students to those qualified to help them in other matters. However, the final responsibility for meeting all academic requirements for a selected program rests with the student.

Course of Study

A student should refer to the requirements of his/her respective department or school for his/her program of study and confer with his/her advisor whenever problems arise. The student is expected to follow the program of academic work outlined as closely as possible.

Official Registration

Registration is a time designated each semester to allow the student and his/her advisor to review the student's records and plan a program for the next semester.

The student has an opportunity to discuss academic problems with the advisor. Registration helps to ensure that the courses requested on the registered schedule will be available to the student the following semester.

Any student who is enrolled in the University during the registration period is expected to register during the period designated for this purpose.

In order for a student to get credit for a course, he/she must be properly registered in that course. This means that the student must have gone through the registration procedures as outlined by the University. Further, the student must have paid all required tuition and fees.

Late Registration

A student is expected to complete enrollment (including the payment of all required fees) on the dates listed on the University Calendar. The payment of fees is part of the registration process. No student is eligible to attend classes until the required fees have been paid. A student who fails to complete registration during the scheduled dates will be required to pay a late registration fee of \$20.00 beginning on the date specified in the University Calendar.

Course Load

A full-time graduate course load is 9 to 15 credits per semester (including audits) and 3-7 credits per summer session (including audits). Audits in subjects in which the student has no previous experience will be evaluated at full credit value in determining course load. Audits taken as repetition of work previously accomplished are considered at one half of their value in calculating course loads. With the single exception of foreign language audits, all audit registrations must fall within the range of maximum permissible course loads. The maximum load is 15 semester hours.

Foreign students on F-1 and J-1 visas are required by the Immigration and Naturalization Service to carry a full-time course of study to remain in status.

University Staff

The maximum load for any fully employed member of the University faculty or staff will be six semester hours for the academic year.

Concurrent Registration In Other Institutions

A student registered in a degree program in the School of Graduate Studies may not enroll concurrently in another graduate school except upon permission, *secured in advance*, from the

Dean of the School of Graduate Studies.

Grading Policies

Grades for graduate students are recorded as follows: A, excellent; B, average; C, below average; F, failure; S, work in progress (for courses in research); I, incomplete; W, withdrawal.

1. In order to earn a degree, a student must have a cumulative average of "B" (a grade point average of 3.0 on a system in which one hour of "A" earns 4 grade points).
2. A graduate student automatically goes on probation when his/her cumulative average falls below "B."
3. A student may be dropped from the degree program if he/she has not been removed from probation after two successive terms as a full-time student.
4. A student may not repeat a required course in which "C" or above was earned.
5. A student may repeat a required course in which "F" was earned. A student may not repeat the course more than once. If a student fails a second time, he/she is dismissed from the degree program.
6. All hours attempted in graduate courses and all grade points earned are included in the computation of the cumulative average of a graduate student.
7. A student who stops attending a course but fails to withdraw officially may be assigned a grade of "F."
8. All grades of "I" must be removed during the student's next term of enrollment.
9. A student may not count towards a degree program any course in which a grade of "F" was earned.

NOTE: The North Carolina Department of Public Instruction does not accept courses in which a student has received a "D" or "F" for renewal of certification.

Audit

A regular student may audit a course by picking up the Audit Form from the Office of the Registrar. He/she must register officially for the course and pay the University Cashier. Attendance, preparation, and participation in the classroom discussion and laboratory exercises shall be at the discretion of the instructor.

A student who audits courses is not required to take examinations or tests and he/she receives no credit. An auditor may not change his/her registration from audit to credit or from credit to audit after late registration ends. COURSE AUDITING IS WITHOUT CREDIT.

Change of Grade

A request for a change of grade, for any reason, must be made within one year following the date the original grade was assigned by the faculty member.

Grade Appeal

A student may appeal the final grade earned in a course. Initially, the student should attempt to resolve the matter informally through meeting with the instructor of the course, the department chairperson, and/or dean of the academic unit in which the grade was assigned. If the matter is not resolved through this level of interaction, then the student should consult the individual school/college on its written grade appeal policy. A student wishing to pursue a written appeal of a grade must demonstrate a legitimate basis for the appeal. Grade appeal decisions are final at the level of the school/college.

Academic Warning, Probation, and Dismissal

A cumulative grade point average of 3.0 (B) is required for graduation. A department shall recommend courses in which the grades of "B" or better will be required. Effective fall 2004, *"A student who accumulates nine or more semester hours of grades below "B" shall be dismissed. When a student's grade point average (GPA) falls below 3.0, he/she will be warned and informed that he/she must raise the GPA to 3.0 or better within the next nine semester hours. Students failing to do so will be dismissed from the School of Graduate Studies and no further registration in a graduate classification will be permitted."*

Graduate-level courses with a grade below "C" are not acceptable in a program of study. In addition, graduate transfer courses with a grade of "C" or lower are not acceptable in the program of study. See section on Grading Policies.

Eligibility for Assistantship

A graduate student must be in good academic standing (3.0 GPA or better) to be eligible for appointment to an assistantship, fellowship, scholarship or traineeship, and must be

registered in each semester in which the appointment is in effect.

Changing Programs

A student may transfer from one School/College of the University to another with the written approval and acceptance of the graduate programs involved. The proper forms on which to apply for such a change are to be obtained from the School of Graduate Studies Office and executed at least six weeks prior to the beginning of the semester in which the student plans to transfer. When such a transfer is made, the student must satisfy the current academic requirements of the School/College and/or department into which the student has transferred.

Withdrawal from the University

A student who wishes or is asked to leave the University at any time during the semester shall execute and file an official withdrawal form. This form may be obtained from the Counseling Services. The form should be completed and submitted to the Office of the Registrar.

A student who withdraws from the University within 15 calendar days of the beginning of the final examination period for the semester shall receive a "W" in all classes enrolled. Failure to execute and file this form in a timely manner will result in a student receiving an "F" for each course in which he/she was enrolled during the semester in question.

Incompletes

A student is expected to complete all requirements of a particular course during the semester in which he/she is registered. However, if at the end of the semester a small portion of the work remains unfinished and should be deferred because of some serious circumstances beyond the control of the student, an "I" may be submitted.

Along with the recording of the incomplete grade, the instructor must also file with the chairperson of the department the student's average grade and a written description of the work that must be completed before the incomplete is removed.

Procedure for the Removal of an Incomplete

An incomplete grade must be removed within SIX WEEKS after the beginning of the next semester. If the student has not removed the incomplete within the time specified, the incomplete is automatically changed to an "F." Developmental, thesis, and research courses are exempted from the six-week time limit.

Continuous Registration

After a student is admitted to the School of Graduate Studies and enrolls for the first time, she/he is required to maintain continuous registration, i.e., be enrolled each semester, excluding summer sessions, until he/she has either graduated or her/his graduate program at North Carolina A&T State University has been terminated. All students must be registered in the semester or summer session in which they formally complete their degree requirements.

A student in good academic standing who must interrupt his/her graduate program for good reasons may request a leave of absence from graduate study for a definite period of time, normally not to exceed one year. The request should be made at least one month prior to the term involved. Upon endorsement of the request by the student's graduate advisory committee and Director of Graduate Programs, and approval by the School of Graduate Studies, the student will not be required to be registered during the leave of absence. The time that the student spends on an approved leave of absence will be included in the time allowed to complete the degree, i.e., six years for the master's and ten years for the doctorate.

Graduate students whose programs have been terminated because of failure to maintain continuous registration and who have not been granted a leave of absence will be required to complete a new application and be formally accepted into the program of study again.

Changes in Schedule

A change in a student's class schedule may be made with the consent of his/her advisor or department chairperson. However, if a student's schedule is changed after the designated drop add period, the consent of the Dean of the School of Graduate Studies is required.

The student must obtain and properly execute the Change of Schedule Form. This form is obtained from the Office of the Registrar and should be returned to that office.

Class Attendance Policy

Class Attendance

The University is committed to the principle that regular and punctual class attendance is essential to the student's optimum scholastic achievement. An absence, excused or unexcused, does not relieve the student of any course requirement. Regular class attendance is a student's obligation, and a student is responsible for all the work, including tests and written work requested or assigned during all class meetings.

Instructor's Responsibility

- 1) Description of attendance requirements should be stated in the course syllabus and announced in class, particularly at the beginning of each term. If class attendance is to affect a student's course grade, then a statement to that effect must be a part of the course syllabus distributed to each student.
- 2) Instructors will keep attendance records in all classes. Each instructor has the right to prescribe procedures as to how and when attendance will be taken.

Student's Responsibility

It is the responsibility of each student to learn and comply with the requirements set by the instructor for each class in which he/she is registered. The student should

- 1) have knowledge of each instructor's attendance and monitoring practices for class absences during the term.
- 2) become familiar with all materials covered in each course during absences, and make up any work required by the instructor.
- 3) initiate the request to make up work on the first day of class attendance after the absence.

Policy on the Make-up of Required Course Work

The administration, faculty, and staff recognize that there are circumstances and events which require students to miss classes and the required course work which may be performed or required on the day of the absence. Also, they recognize that required course work is needed to give each student an adequate performance evaluation. Therefore, whenever reasonable (and more specifically described below), students should be allowed to make-up required work.

The following definitions will apply with respect to this policy:

- a) Required course work—All work which will be used in the determination of final grades, e.g., examinations, announced quizzes, required papers and essays, required assignments.
- b) Instructor—Person responsible for the course and providing instruction and evaluation.
- c) Permissible reasons for requesting the make-up of required work: Sickness (verification needed); death of relatives (immediate family); participation in approved University related activities; or acting in the capacity of a representative of the University (band, choir, sports related travel, etc.). Extraordinary circumstances (court appearance, family emergency, etc.)—require a signed statement. NOTE: Other reasons for requesting the make-up of required course work are not acceptable.

Grade Reports

As soon as grades are determined, at the end of each semester or summer term, students may go to the website at <https://webfor1.ncat.edu/>, and retrieve their grades.

Privacy of Student Records

The University ensures students access to their official academic records but prohibits the release of personally identifiable information, other than "directory information," from these records without their permission, except as specified by public law 93-380. "Directory information" includes the following: Student's name, address, telephone number, email address, date and place of birth, school, major, sex, marital status, dates of attendance, degree received, honors received, institution(s) attended prior to admission to North Carolina Agricultural and Technical State University, past and present participation in officially recognized sports and activities, and physical factors. Public Law 93-380 further provides that any student may, upon written request, restrict the printing of such personal information relating to himself or herself as is usually included in campus directories. A student who desires to have "directory information" withheld, must get the "nondisclosure" form from the Office of the Registrar. The form should be returned one week before the beginning of classes for the semester or session in which the student is enrolled.

Access to Student Records

1. The policy for the administration of student academic records is in accordance with the Family Educational Rights and Privacy Act of 1974 as amended.
2. A student has the right to inspect and review any and all official records, files, and data directly related to him/her.
3. A student who believes that his/her record contains inaccurate or misleading information shall have an opportunity for a hearing to challenge the content of the record to ensure that the record is not inaccurate, misleading, or otherwise in violation of his/her privacy or rights, and to provide an opportunity for the correction or deletion of any such inaccurate, misleading, or otherwise inappropriate data contained therein or for the inclusion of the student's own statement of explanation.
4. The University will comply with a request from a student to review his/her record within a reasonable period of time and not later than thirty (30) days after the request is received.
5. The release of academic records requires the written permission of the student, except as provided by Public Law 93-380. Transcripts are not issued to a student who has not met his/her financial obligations to the University.
6. Copies of the "University's Statement" concerning access to students' records are available in the Office of the Registrar, as well as the office of each school/college dean and department chairperson.

Change of Name and Address

It is the obligation of every student to notify the Office of the Registrar of any change in name or address. The student may also complete the change of address form online by visiting the website at <https://webfor1.ncat.edu/>. Failure to do so can cause serious delay in the handling of the student's records and in notification of emergencies at home. *A legal court document must accompany the request to change the student's name.*

Transcripts of Records

Requests for official transcripts of students' records should be addressed to the University Registrar. The cost is \$2.00 per copy.

Indebtedness to the University

No diploma, certificate, or transcript of a record will be issued if a student has not made satisfactory settlement with the cashier for all indebtedness to the University. A student may not be permitted to attend classes or take final examinations after the due date of any unpaid obligation.

Academic Dishonesty Policy

North Carolina A&T State University is committed to a policy of academic honesty for all students. Examples of Academic Dishonesty include but are not limited to the following:

- Cheating or knowingly assisting another student in committing an act of academic dishonesty.
- Plagiarism (unauthorized use of another person's words or ideas as one's own) which includes but is not necessarily limited to submitting examinations, theses, reports, drawings, laboratory notes, or other materials as one's own work when such work has been prepared by another person or copied from another person.
- Unauthorized possession of examinations or reserved library materials, destruction or hiding of source materials, library materials, or laboratory materials, or experiments, or any other similar action.
- Unauthorized changing of grades or marking on an examination or in an instructor's grade book, or such change of any grade record.
- Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct.
- Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action but may also affect the evaluation of the student's level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action as defined below.

In instances where a student has clearly been identified as having committed an academic

act of dishonesty, the instructor may take appropriate punitive action including a loss of credit for an assignment, an examination or project, or awarding a grade of "F" for the course subject to the review and endorsement of the chairperson and the dean. Repeated offenses can even lead to dismissal from the University.

Student Appeals on Academic Dishonesty

A student who feels unfairly treated as a result of an academic dishonesty matter may appeal the action in writing to the University Judicial Tribunal. The written notice of appeal must be submitted within one week (seven calendar days) of the date of the incident. The student should refer to the section on Appellate Procedures in the Student Handbook.

Graduation

There are four official graduations (June, August, December and May) for graduate students per year, occurring at the end of the fall and spring semesters and at the end of the second summer session. Formal commencement exercises are held at the end of the spring and fall semesters, but any student who graduated during summer sessions is eligible to participate in the December Commencement. Any doctoral candidate wishing to have the degree conferred *in absentia* must notify the School of Graduate Studies in writing; master's candidates should contact their departments or programs. **Students must be enrolled in the semester in which they apply for graduation.**

TUITION AND FEES

The fee charged to a full-time student carrying nine or more semester hours of work is the same as that charged to a full-time undergraduate student. For one academic year, a state resident should expect to pay approximately \$3,138.00, which will cover tuition and required fees; this sum does not include room and board charges. Tuition and required fees for an out-of-state student carrying a full schedule will total \$12,723.00 for the academic year. Current room and board rates are \$2,484.00 per semester.

As student fees are subject to change without prior notice, it is advised that the Treasurer's Office be contacted for complete information concerning charges for full-time and part-time students.

Special Fees

Fee for processing admission application	\$45.00
Late Registration	\$20.00
Graduation fees:	
Diploma	\$60.00
Regalia (<i>cap and gown</i>)	\$20.00
Transcript	\$2.00
Master's Thesis and Dissertation binding fee	\$48.00

EXPENSES AND FINANCIAL AID

General Information

NORTH CAROLINA A&T STATE UNIVERSITY IS A PUBLICLY SUPPORTED INSTITUTION. TUITION PAYMENTS AND OTHER REQUIRED STUDENT FEES MEET ONLY A PART OF THE TOTAL COST OF EDUCATION OF STUDENTS ENROLLED. ON THE AVERAGE, FOR EACH FULL-TIME STUDENT ENROLLED IN AN INSTITUTION OF THE UNIVERSITY OF NORTH CAROLINA, THE STATE OF NORTH CAROLINA APPROPRIATED \$8,558 PER YEAR IN PUBLIC FUNDS TO SUPPORT THE EDUCATIONAL PROGRAMS OFFERED.

THE UNIVERSITY RESERVES THE RIGHT TO INCREASE OR DECREASE ALL FEES AND CHARGES AS WELL AS ADD OR DELETE ITEMS OF EXPENSE WITHOUT ADVANCED NOTICE AS CIRCUMSTANCES, IN THE JUDGMENT OF THE ADMINISTRATION, MAY REQUIRE.

Boarding and Lodging fees are based on the actual number of days school is in session and do not include holidays, breaks, or any other University vacations. Students' property in dormitories and other University buildings is at the sole risk of the owner, and the University is not responsible for loss, theft, or damage to such property arising from any cause.

Students are required to pay for any loss or damage to University property cost due to abuse, negligence, or malicious action at replacement, in addition to being subject to disciplinary action for such loss or damage.

All undergraduate and graduate students are required to purchase all textbooks. This includes hardcover and paperback textbooks. The cost will vary according to academic discipline. Other policies and procedures governing the book-purchase system can be obtained from the University Bookstore.

Personal spending money should be sent directly to and made payable to the student in the form of money orders or certified checks. As a policy, the University does not cash personal checks for students in any amount.

Grades, diplomas and transcripts are withheld until the student has paid in full all fees and charges due to the University. A student in debt to the University in any amount will not be permitted to enroll for any subsequent semester until his or her obligations are paid. If special financial arrangements have been made, failure to comply with these arrangements as stipulated will result in the student forfeiting his/her privilege to receive special financial arrangements for deferments in the future.

Special Notice to Veterans

Veterans attending school under the provisions of Public Law 89-358 receive a monthly subsistence allowance from Veterans Administration. Therefore, veterans are responsible for meeting all of their required fee obligations.

Veterans attending school under the provision of Public Law 894 (Disabled Veterans) receive a monthly subsistence allowance from Veterans Administration. Also, Veterans Administration pays directly to the school the cost of the veteran's tuition and required fees. All other fees are the responsibility of the veteran.

Veterans may contact the Veterans Affairs Office on Campus for any special consideration which may be available.

Auditing

To audit a course, a student must obtain permission from the Dean of the School of Graduate Studies and must submit the necessary forms during the registration period. A part-time student must pay all fees, including tuition, that would be charged to a student taking the course for credit. A full-time student is not required to pay any additional fees for auditing. A change from credit registration to audit will not be permitted after late registration ends. An auditor is not required to participate in class discussions, prepare assignments, or take examinations.

Full-Time Faculty and Employees

Full-time employees of the University who hold membership in the Teachers' and State Employees' Retirement System may register for credit or as auditors with free tuition privileges for one course in any academic term at any campus of the University of North Carolina. Each applicant for free tuition must submit through regular channels a form provided by the University. COURSE AUDITING IS WITHOUT CREDIT.

Refund Policy

Refunds for official withdrawals from North Carolina A&T State University are prorated, based upon the percentage of the enrollment period attended. No refunds are made for official withdrawals after the fifth week of the enrollment period. The prorated withdrawal schedule is publicized in the schedule of classes booklet and through other University media.

Residence Status for Tuition Purposes

The basis for determining the appropriate tuition charge rests upon whether a student is a resident or a nonresident for tuition purposes. Each student must make a statement as to the length of his or her residence in North Carolina, with assessment by the institution of that statement to be conditioned by the following.

Residence. To qualify as a resident for tuition purposes, a person must become a legal resident and remain a legal resident for at least twelve months immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, twelve months legal residence means more than simple abode in North Carolina. In particular, it means maintaining a domicile (permanent home of indefinite duration) as opposed to "maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education." The burden of establishing facts which justify classification of

a student as a resident entitled to in-state tuition rates is on the applicant, who must show his or her entitlement by the preponderance (the greater part) of the residency information.

Initiative. Being classified a resident for tuition purposes is contingent on the student's seeking such status and providing all information that the institution may require in making the determination.

Parents' Domicile. If an individual, irrespective of age, has living parents(s) or court appointed guardian of the person, the domicile of such parent(s) or guardian is, prima facie, the domicile of the individual; but this prima facie evidence of the individual's domicile may or may not be sustained by other information. Further, no domiciliary status of parents is not deemed prima facie evidence of the applicant child's status if the applicant has lived (though not necessarily legally resided) in North Carolina for the five years preceding enrollment or re-registration.

Effect of Marriage. Marriage alone does not prevent a person from becoming or continuing to be a resident for tuition purposes, nor does marriage in any circumstance ensure that a person will become or continue to be a resident for tuition purposes. Marriage and the legal residence of one's spouse are, however, relevant information in determining residency intent. Furthermore, if both a husband and his wife are legal residents of North Carolina and if one of them has been a legal resident longer than the other, then the longer duration may be claimed by either spouse in meeting the twelve-month requirement for in-state tuition status.

Military Personnel. A North Carolinian who serves outside the State in the armed forces does not lose North Carolina domicile simply by reason of such service. And students from the military may prove retention or establishment of residence by reference, as in other cases, to residency acts accompanied by residency intent.

In addition, a separate North Carolina statute affords tuition rate benefits to certain military personnel and their dependents even though not qualifying for the in-state tuition rate by reason of twelve months legal residence in North Carolina. Members of the armed services, while stationed in and concurrently living in North Carolina, may be charged a tuition rate lower than the out-of-state tuition rate to the extent that the total of entitlements for application tuition costs available from the federal government, plus certain amounts based under a statutory formula upon the in-state tuition rate, is a sum less than the out-of-state tuition rate for the pertinent enrollment. A dependent relative of a service member stationed in North Carolina is eligible to be charged the in-state tuition rate while the dependent relative is living in North Carolina with the service member and if the dependent relative has met any requirement of the Selective Service System applicable to the dependent relative. These tuition benefits may be enjoyed only if the applicable requirements for admission have been met; these benefits alone do not provide the basis for receiving those derivative benefits under the provisions of the residence classification status reviewed elsewhere in this summary.

Grace Period. If a person (1) has been a bona fide legal resident, (2) has consequently been classified a resident for tuition purposes, and (3) has subsequently lost North Carolina legal residence while enrolled at a public institution of higher education, that person may continue to enjoy the in-state tuition rate for a grace period of twelve months measured from the date on which North Carolina legal residence was lost. If the twelve months ends during an academic term for which the person is enrolled at a State institution of higher education, the grace period extends, in addition, to the end of that term. The fact of marriage to one who continues domiciled outside North Carolina does not by itself cause loss of legal residence marking the beginning of the grace period.

Minors. Minors (persons under 18 years of age) usually have the domicile of their parents, but certain special cases are recognized by the residence classification statute in determining residence for tuition purposes.

- (a) If a minor's parents live apart, the minor's domicile is deemed to be North Carolina for the time period(s) that either parent, as a North Carolina legal resident, may claim and does claim the minor as a tax dependent, even if other law or judicial act assigns the minor's domicile outside North Carolina. A minor thus deemed to be a legal resident will not, upon achieving majority before enrolling at an institution of higher education, lose North Carolina legal residence if that person (1) upon becoming an adult "acts, to the extent that the person's degree of actual emancipation permits, in a manner consistent with

bona fide legal residence in North Carolina” and (2) “begins enrollment at an institution of higher education not later than the fall academic term following completion of education prerequisite to admission at such institution.”

(b) If a minor has lived for five or more consecutive years with relatives (other than parents) who are domiciled in North Carolina and if the relatives have functioned during this time as if they were personal guardians, the minor will be deemed a resident for tuition purposes for an enrolled term commencing immediately after at least five years in which these circumstances have existed. If under this consideration a minor is deemed to be a resident for tuition purposes immediately prior to his or her eighteenth birthday, that person on achieving majority will be deemed a legal resident of North Carolina of at least twelve months duration. This provision acts to confer in-state tuition status even in the face of other provisions of law to the contrary; however, a person deemed a resident of twelve months duration pursuant to this provision continues to be a legal resident of the State only so long as he or she does not abandon North Carolina domicile.

Lost but Regained Domicile. If a student ceases enrollment at or graduates from an institution of higher education while classified a resident for tuition purposes and then both abandons and reacquires North Carolina domicile within a 12-month period, that person, if he or she continues to maintain the reacquired domicile into re-enrollment at an institution of higher education, may re-enroll at the in-state tuition rate without having to meet the usual twelvemonth durational requirement. However, any one person may receive the benefit of the provision only once.

Change of Status. A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) must be classified by the admitting institution either as a resident or as a nonresident for tuition purposes prior to actual enrollment. A residence status classification once assigned (and finalized pursuant to any appeal properly taken) may be changed thereafter (with corresponding change in billing rates) only at intervals corresponding with the established primary divisions of the academic year.

Transfer Students. When a student transfers from one North Carolina public institution of higher education to another, he or she is treated as a new student by the institution to which he or she is transferring and must be assigned an initial residence status classification for tuition purposes.

Financial Support for Graduate Students

Financial aid is money awarded to assist students in paying for the cost of an education. Applying and receiving financial aid is a simple process. Students apply for need-based and some non-need-based financial aid by completing the Free Application for Federal Student Aid (FAFSA). Students should complete this form immediately after January 1. There is no processing fee and all graduate students are encouraged to complete the application. Students can submit the FAFSA on the Web (<http://www.fafsa.ed.gov>) or mail the form to the Federal Processing Center. North Carolina A&T State University school code is **002905**. The University's priority deadline for receipt of the FAFSA is **March 15th**; however, students who miss the deadline are still encouraged to complete and mail the FAFSA as soon as possible.

A financial aid award will not be offered until a student is admitted to the University. Therefore, it is important that the admission procedure be completed as soon as possible.

A student enrolled as a “Post-baccalaureate Studies (PBS)” student is not eligible to receive Federal and State financial aid unless enrolled in a Teacher Certification Program. The student must petition the Dean of Graduate Studies to have his/her status reviewed and changed, if applicable.

All students must re-apply for financial assistance each academic year and separately for summer school.

Types of Available Funds

Graduate students are eligible for Assistantships, Stipends, Scholarships, Work, Loans and some Grants. Work assistance must be earned and loans must be repaid.

Graduate Assistantship

A limited number of graduate assistantships are available to qualified individuals. The student is assigned to assist a professor or a department for a limited number of hours for the duration

of the assistantship. Some graduate assistants are assigned to teach freshman classes. Normally, a graduate assistant will be assigned to teach only one class per semester, but he/she may be assigned to teach a maximum of two classes. The assistantship offers a stipend that will assist a student to pay required tuition, fees, books, and room and board. Application for an assistantship must be made to the Dean of the School of Graduate Studies at least five months before fall registration. Only full-time graduate students are eligible.

Stipends

Stipend scholarships are considered a resource for financial aid purposes and must be included in the financial aid award. If the student receives stipend assistance, the amount may reduce or cancel federal or state financial assistance.

Course Work – Masters and Doctoral students must enroll in at least half time (**5 hours**) of **graduate course work (600 or 700 course level)** to be eligible for a Federal Direct Student Loan. The University considers 9 hours to be full-time; therefore, half-time would be 5 hours. Financial aid for Graduate students will not cover undergraduate courses taken unless the student is enrolled in the Teacher Certification Program.

Scholarships

The majority of scholarships at NC A&T State University are awarded through the academic department. Students are strongly urged to contact their academic department for additional scholarship information. Students receiving an outside scholarship should forward a copy of the notice to the Student Financial Aid Office. The scholarship will be included in the student's award and may cause an adjustment to the current award package. All scholarship checks should be made payable to North Carolina A&T State University and mailed to the Treasurer's Office. The check should include the student's name and social security number.

Federal Work Study

Federal Work-Study is available to eligible students. Job assignments are available to graduate students with financial need. The Federal Work-Study Program provides students the opportunity to earn part of their educational expenses and to gain valuable work experience for future reference. The total amount of the award is listed on the award notification. Students who are awarded Federal Work-Study must pick up an assignment form from the Student Financial Aid Office at the beginning of the Fall semester. Students cannot begin work until an authorization is received and returned to the Student Financial Aid Office. Students should

report back to the assigned department in the Spring semester. The Student Financial Aid Office is not responsible for paying hours which exceed the award amount. Students working on campus are paid monthly, normally, on the 15th of each month. It is the student's and supervisor's responsibility to ensure that the award amount is not exceeded. Time sheets are due in the Student Financial Aid Office monthly in order for the student to be paid. Time sheets received after the due date will be held until the next payroll. Checks are distributed from the Treasurer's Office. The Federal Work-Study award cannot be used toward payment of University fees at registration.

Loans

The Student Financial Aid Office awards funds through the Federal Direct Loan Program to Graduate Students. This is a loan and must be repaid with interest. There are two types of Federal Direct loans. Subsidized Loans are based on financial need and the government pays the interest on the student's behalf as long as the student is attending school at least half-time (5 or more hours per semester). The student is responsible for the interest payments on an unsubsidized loan. The interest is billed quarterly. Students can allow the interest to be capitalized and added to the principal, if payment cannot be made. Students must sign a promissory note. Promissory notes are signed via the web. Students are encouraged to borrow the minimum loan amount. If this is the student's first time borrowing at NC A&T State University, the borrower must attend an entrance counseling session before the first disbursement is made. Students should review the promissory note for the expected disbursement dates. Loan funds will be applied to the student's account according to the University's schedule. The loan is disbursed in two payments. Generally, refunds are available from the Treasurer's Office five to ten days after the loan is applied to the account.

Students are notified of the amount of aid received through the award notification. The award notification indicates the gross amount of the loan for the fall and spring semester and/or summer sessions. The student's account and bill indicate the actual amount received. Students have the right to cancel all or part of the loan within 14 days after disbursement. Students interested in canceling or reducing their loan must notify the Student Financial Aid Office in writing. The correspondence must be received in the Student Financial Aid Office within fourteen days from the date of the bill; otherwise, the loan will remain on the student's account. If the loan is canceled, the student is responsible for any outstanding account balance.

Adjustment to an Award – Financial aid budgets and awards will be adjusted for graduate students enrolled less than nine (9) hours. Adjustments will be based on the hours enrolled as of the census date. If adjustments are made and the student has received a refund, the student will be responsible for any balance due to the University.

Teacher Certification – Students working on Teaching Certification only are eligible to receive a Federal Direct Student Loan provided the student is enrolled in at least six (6) credit hours. The loan can only be awarded at the undergraduate fifth year level. Students can only borrow at the fifth grade level only twice. Students cannot exceed the aggregate maximum loan amount as an undergraduate student.

Revision or Cancellation of Aid - The Student Financial Aid Office reserves the right to revise or cancel the award because of changes in your financial or academic status or if you receive additional financial assistance. The submission of false or misleading information will be considered immediate grounds for cancellation of aid. If you receive additional scholarships or loans that cause your award to exceed need or the cost of attendance at the University, your financial aid award will be reduced or canceled to prevent the over-award or over-budget.

Withdrawals - Students withdraw from the University for various reasons. Students withdrawing from the University should follow the withdrawal procedure. The Federal Government has implemented a withdrawal policy for institutions. It is called the Return of Title IV Funds. If you receive financial aid and withdraw before the mid-point of the semester, you may be required to repay any refund received and other aid disbursed on your account. You will be notified, in writing, of the amount that must be repaid.

Summer School

Students interested in attending Summer School must complete a separate application and have a current year FAFSA on file. Graduate students generally receive only the Federal Direct Student Loan, if there is remaining eligibility. All students must attend the First Summer Session to be eligible for a Direct Loan. A student must enroll in at least five credit hours (halftime) to receive loan assistance. Students who are not maintaining satisfactory academic progress should attend summer school to remove the deficiency, but will not be eligible for financial assistance.

SATISFACTORY ACADEMIC PROGRESS

GRADUATE ELIGIBILITY*

To be in compliance with the Satisfactory Academic Progress standards, graduate students must meet the following requirements to continue receipt of financial aid:

- A. They must have a cumulative grade point average (gpa) of 3.0 or better at the end of each academic year.
- B. If full-time, graduate students must earn 9 hours each semester.
- C. If less than full-time, graduate students must pass all hours attempted during the semester.
- D. They must not exceed 54 attempted hours. Majors in Counseling Education, Agency Counseling and Business and Industry must not exceed 90 attempted hours.
- E. They must not exceed six semesters of full-time enrollment (full-time is 9 or more hours.)

Failure to earn the required hours and/or grade point average will result in the student being suspended from financial aid. Students can attend summer school to make up the deficiency; however, the student is responsible for payment of charges. Additional information on financial aid programs can be obtained from the University website (<http://www.ncat.edu>).

Immunization for Graduate Students

All full-time graduate students admitted to a degree program are required by State Law to submit a report of medical history and immunization documentation prior to completing their initial registration. North Carolina A&T State University students returning to the School of Graduate Studies must have their medical history file updated. The required immunizations must be submitted to the student health center before registration for classes. If this requirement is not met, dismissal from school is mandatory under state law. Students taking evening (after 5:00 p.m.) and weekend classes are not required to submit immunizations. The following immunizations are required by state law and are offered at the Student Health Center for the following cost:

North Carolina Immunization Requirement

AGE (18-29 years)

2 measles vaccines
1 rubella
1 mumps
or
2 doses of MMR
and
1 Td booster or
Td series with booster

AGE (30-49 years)

1 rubella vaccine
1 Td booster or
Td series with booster

AGE (50-over)

1 Td booster
Td series with booster

Additionally, International students are required to have a TB skin test and negative result or chest x-ray.

Tetanus (within ten years)	\$10.00
MMR (measles, mumps, rubella)	\$10.00
— 1 vaccine for students 30 years and older,	
— 2 vaccines for students under age 30	
Tuberculin skin test for international students	\$ 5.00

GRADUATE STUDENTS ARE NOT REQUIRED TO HAVE A PHYSICAL EXAMINATION.

However, for new students who have been accepted, please complete the medical history form enclosed in your graduate admission packet, and return it to:

**Sebastian Health Center
North Carolina A&T State University
Greensboro, North Carolina 27411
Attention: Medical Records**

HEALTH SERVICES

<http://www.ncat.edu/~health>

The Director of Health Services manages the Sebastian Health Center. Medical services are available to all students that have paid the student health fee as part of their general university fee.

The basic components of the Health Service Program are as follows:

1. **Medical Services:** The University Physician/s are on duty in the Health Center daily (hours for routine treatment are posted) — and “on 24 hour call” for emergency situations. A staff psychiatrist is also available by appointment.
2. **Nursing Services:** Under the direction of the Nurse Supervisor, registered nurses are in attendance daily to evaluate and treat health needs and answer any question pertaining to health problems and other concerns.
3. **Laboratory Services:** A Certified Medical Technologist is on duty Monday – Friday to perform various laboratory tests as ordered by the physician to diagnose a variety of medical problems.
4. **Medical Records:** The Medical Records Director is responsible for maintaining a secure and confidential file of all student health records in the Health Center. Additionally, the North Carolina State Immunization Law stipulates required vaccines must be on file in the medical records department of the Health Center prior to registration.
5. **Pharmacy Services:** A registered pharmacist is available Monday-Friday to dispense medication and provide patient counseling about prescriptions filled.
6. **Health Education Services:** Health education is available through the health educators on a variety of health concerns or issues. The Health Educators are available Monday-Friday to assist students with all health issues or concerns.

The Center provides up-to-date and emerging information on health related issues and concerns on a continuing basis for the University community.

INTERNATIONAL STUDENTS AND SCHOLARS OFFICE

International Students and Scholars Office
Room 221 Murphy Hall - (336) 334-7551 – (336) 334-7001-fax
www.ncat.edu/~isso
isso@ncat.edu

The International Students and Scholars Office (ISSO) provides programs, services and assistance to non-immigrants and immigrants who choose, and are admitted to pursue courses of study at North Carolina A&T State University. These services include:

- Issuance of the I-20/DS-2019 Certificate of Eligibility
- Pre-arrival assistance and information
- Arrival/adjustment assistance
- Housing information and contacts
- Insurance requirements
- Immigration status matters
- Permanent Resident, U.S. Naturalization, Resident Alien, and Asylum Verification

Orientation and status advisement are provided throughout the matriculation process in group and/or individual sessions. In cooperation with departments and organizations, including the International Students Association (ISA), the Office provides activities that enhance cultural, social, and personal development. The University also affiliates with local and national organizations promoting multicultural understanding and involvement in the Greensboro community. This exposure offers participation in a variety of activities and service related projects both on campus and within the City. Currently, over 150 international students attend the University and represent 50 countries.

All foreign born students applying to the University are required to verify their immigration/residency status prior to moving forward in the enrollment process. This requires that international applicants maintain close contact with the International Students and Scholars Office (ISSO) and notify the ISSO immediately of any change in immigration status. Local address changes during application and enrollment must also be updated and reported through SEVIS within 10 days for students in either F-1 or J-1 status.

The ISSO works closely with the graduate admissions process and will not issue the Certificate of Eligibility (I-20) to F-1 Status applicants nor the Certificate of Eligibility (DS-2019) to J-1 status applicants until

all of the admissions requirements are met or waived. **Certificates of Eligibility (I-20) and/or (DS-2019) issued by another institution are not valid at North Carolina A&T State University.**

Certificates of Eligibility will be issued by the ISSO to prospective students prior to enrollment after the following have been satisfied:

1. Documentation of the TOEFL score (550 or above)
2. Transcript evaluation by an internationally approved credentials evaluation agency at the applicant's expense
3. Receipt of certified financial guarantee documents (letter of support, bank statement, and verification of salary from sponsor's employer)
4. A deposit for the first year's tuition and fees, including the cost of mandatory insurance coverage
5. Proof of valid immigration status if the applicant is currently residing in the United States
6. Transfer waiver if applicant is transferring to the University from within the United States
7. Financial guarantee at the rate of \$6,000 for spouse and \$4,000 for minor dependents, if a student is bringing them with him/her to the United States

Information regarding the Graduate Record Examination (GRE) and other admissions requirements are available through the School of Graduate Studies. Please refer to the University website, <http://www.ncat.edu/~gradsch/>, or call (336) 334-7920.

While attending North Carolina A&T State University, non-immigrants are required to maintain lawful status with the **Citizenship & Immigration Services (CIS)** and the Department of State (DoS). New rules and regulations effective January 1, 2003 require that students at the graduate level:

- a. Enroll in and maintain a minimum of nine (9) semester hours (six if approved for an assistantship)
- b. Maintain a minimum grade point average of 3.0
- c. Complete all provisions for acceptance within the first semester or as required by the School of Graduate
- d. Provide changes in status and address to the ISSO **within 10 days of the change**
- e. Attend required ISSO Orientation at the beginning of each semester
- f. Maintain mandatory insurance coverage for self and all dependents
- g. Complete registration and provide proof of enrollment and insurance coverage within 15 days after classes begin

Legal regulations governing non-immigrant students are complex. The ISSO is available to discuss implications and explain the impact of these regulations in detail. Orientation sessions will also be helpful in understanding **CIS** and DoS regulations.

Scholarships are not usually available to non-immigrant applicants; however, students may contact the academic department to which they have applied to determine the availability of assistantships or scholarships. Availability is highly competitive and interested candidates should make contact immediately. Scholarships are not available through the ISSO.

International students are classified as non-residents of North Carolina and are assessed non-resident (out-of-state) tuition and fees.

F-1 non-immigrants are not eligible to work off-campus without **an** approval from the U.S. **Citizenship and Immigration Services**. It is also necessary to apply for a Social Security card which could take up to two months to process and be received. Work on campus, after the Social Security card has been received, is a possibility and requires that international students maintain legal status at all times. F-2 and H-4 non-immigrants are not eligible to work. **J-2 dependents can apply to the USCIS for work authorization.** Students should contact the ISSO regarding eligibility to work after enrolling in classes.

The ISSO is located on the corner of Nocho Street and S. G. Thomas Drive in Room 221 Murphy Hall. Phone (336) 334-7551, Fax (336) 334-7001. **Please visit the webpage at www.ncat.edu/~isso. The e-mail address is isso@ncat.edu.**

Non-immigrant students are required to maintain comprehensive health and accident insurance coverage that includes repatriation and medical evacuation. Students must purchase insurance on a semester basis during registration. The University offers an acceptable plan.

Government sponsored students and students with pre-existing medical conditions should **consult the ISSO advisor immediately regarding coverage**. Non-immigrant **students** who **fail** to provide proof of adequate insurance by the end of the regular registration **period** will be considered out of status
This school is authorized under Federal Law to enroll nonimmigrant students.

GRADUATE PROGRAMS

The School of Graduate Studies offers programs of study leading to the master's degree in 43 fields and the doctorate in three fields. Each student's program is planned with an advisory committee of graduate faculty members to provide the opportunity for gaining advanced knowledge in the particular field of study. Graduate education is the final stage in the development of intellectual independence. It is different from undergraduate education in that the student is encouraged to establish premises, to hypothesize, and to defend both the procedure and the conclusions of independent investigation. The burden of proof for the verifiability of knowledge rests on the student, not on the faculty member. Emphasis is placed upon the student's scholarly development through formal course work, seminars, research, and independent investigation.

Graduate students are expected to familiarize themselves with the requirements for the degrees for which they are candidates and are held responsible for the fulfillment of these requirements.

Master's Degrees

The School of Graduate Studies offers programs of study leading to the Master of Science degree, the Master of Arts degree, Master of Education, Master of Science in Industrial Technology degree and the Master of Social Work degree.

Requirements for Master's Degrees

Graduate Advisor and Graduate Advisory Committee

All students in master's programs must have a graduate advisor who is a member of the Graduate Faculty in the student's major department or program. The graduate advisor is appointed by the Coordinator of Graduate Programs. In addition, all students must have a graduate advisory committee. The advisory committee is composed of at least three members of the Graduate Faculty. The graduate advisor serves as chair or co-chair of the committee. The graduate advisory committee is appointed by the Coordinator of Graduate Programs in the student's department or program. At the time of the request for a permit to schedule the final oral examination, the School of Graduate Studies verifies that the committee is properly constituted.

Plan of Graduate Work

The master's degree candidate must submit an approved Plan of Graduate Work to the School of Graduate Studies during the term in which the candidate will complete 15 or more credits toward the degree sought. If the 15 credits will be completed at the end of a regular semester, the Plan of Graduate Work must be submitted to the School of Graduate Studies Office five working days before registration for the following semester. If the 15 credits will be completed at the end of the summer session, the Plan of Graduate Work should be filed in the School of Graduate Studies within five working days following fall registration. The Plan of Graduate Work lists the committee chairperson, other committee members, and a sequence of courses required for the degree and approved by the student's advisor. Each committee member's signature indicates approval of the Plan of Graduate Work. Upon approval by the School of Graduate Studies, the Plan becomes the student's official guide to completing his/her program. Any changes in the Plan of Graduate Work or exceptions to the schedule for submission of the Plan must be approved by the committee and the Dean of the School of Graduate Studies.

Declaration of Major

A graduate student shall declare and complete the requirements of one master's degree program before declaring another major. This does not prevent a student from changing a declaration of major.

Time Limitation

The master's degree program must be completed within six successive calendar years. Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for out-dated work. Students enrolled in doctoral programs (Electrical, Industrial and Systems, and Mechanical Engineering) should see the appropriate section of the *Graduate Catalog* for details regarding the maximum time allowed to complete the degree programs. When the program of study is interrupted because the student has been drafted into the armed services, the time limit shall be extended for the length of time the student shall have been on active duty, if the candidate resumes graduate work no later than one year following his/her release from military service.

Course Levels

At the University, the department prefix, followed by a three-digit number, is used to designate all course offerings. The first digit indicates the classification level of the course. Courses numbered 600 through 699 are open to seniors and to graduate students. Courses numbered 700 and above are open only to graduate students. At least 50% of the courses counted in the work towards a master's degree must be those open only to graduate students; that is, numbered 700 and above.

Credits

A minimum of 30 semester credit hours is required for most master's degrees; however, some programs require more than 30. Also, in order to gain the breadth desired in their program or to make up deficits in their undergraduate degree, many students will actually take more credit hours than the minimum required by the program.

Residence Requirements

A minimum of three-fourths of the hours required for the master's degree must be earned in residence study at the University.

Transfer or Credit

No more than six hours of the minimal 30-hour requirement will be accepted from other institutions. A graduate course which has been completed with a grade of "B" or better may be considered for transfer to a master's program provided that it has been completed in a graduate or post-baccalaureate classification at an accredited graduate school. Exceptions are allowed for transfer from foreign institutions if the department or program provides the School of Graduate Studies with adequate documentation that the course is relevant to the degree, with appropriate content and level of instruction resulting in student competencies at least comparable to those of students taking the equivalent course at North Carolina A&T State University, and that the course was taught by faculty who are qualified to teach at the master's degree level. Credit accepted by extension reduces the amount of credit that may be transferred from other institutions.

Transfer of Undergraduate Credit

Graduate credit may be allowed for up to 6 hours of the minimal 30-hour requirement for courses taken at North Carolina A&T State University provided that it is at the 600 level or higher, that the grade is "B" or better, that it was not counted to fulfill undergraduate requirements, and that it is recommended by the student's undergraduate advisor prior to enrollment in the course. No graduate credit will be allowed for excess credits completed in an undergraduate classification at another institution.

Credits from Previous North Carolina A&T State University Master's Degree

Only 12 credits from a previous North Carolina A&T State University master's degree may be counted toward the minimal 30-hour requirement.

Language Requirements

A reading knowledge of one foreign language is required by some programs for the Master of Arts and the Master of Science degrees. Other departments may designate that the language requirement be fulfilled from among those languages in which the Department of Foreign Languages conducts testing. Students should contact the major department for specific language requirements.

Thesis

Theses prepared by candidates for the Master of Science and Master of Arts degrees, in programs requiring the thesis, must present an original investigation into a subject which has been approved by the student's advisory committee and the Coordinator of Graduate Programs in the student's major. Four copies of the thesis in final form as approved by the advisory committee, each signed by the members of the advisory committee, must be submitted to the School of Graduate Studies by a specific deadline in the semester or summer session in which the degree is to be conferred. Detailed information on the form and organization of the thesis is presented in the Graduate School's *Thesis and Dissertation Manual*, which is available in the School of Graduate Studies Office or on the website at <http://www.ncat.edu/>.

Final Comprehensive Examination

Students enrolled in a master's degree program or a doctoral degree program may be tested by a comprehensive examination to determine the student's knowledge and skills in a general subject area of concentration. The comprehensive examination date will be announced by the departmental graduate committee chairperson at the beginning of the semester. This examination will be administered to the enrolled student by an examining committee of the department. Eligibility to sit for the examination will be determined by the departmental graduate committee and the results of the examination will be forwarded to the School of Graduate Studies no later than 30 days prior to the end of the semester. Students may only take the comprehensive examination twice.

After a second failure, the student must petition the Coordinator of Graduate Programs and the Dean of the School of Graduate Studies for approval to take the exam a third time. If the student is unsuccessful after the third attempt, the student is dismissed from the Graduate Program.

Comprehensive Final Oral Examination

Candidates for master's degrees must pass a comprehensive oral examination to demonstrate to the advisory committee that he/she possesses a reasonable mastery of the subject matter of the major and supporting fields and that this knowledge can be used with promptness and accuracy. This examination may not be held until all other requirements, except completion of the course work in current registration during the final semester, are satisfied. A request for a permit to schedule the examination may be filed with the Dean of the School of Graduate Studies after the above conditions are met. The School of Graduate Studies will check to determine that the advisory committee and the courses taken by the student meet the requirements. If all requirements are met, the permit to schedule the final examination will be forwarded to the Director of Graduate Programs within 20 days of receipt of the request. Upon receipt of the permit, the student may proceed to schedule the exam at a time that is convenient to all members of the advisory committee. In those programs that require the thesis, the thesis must be submitted in complete form, except for such revisions necessary as a result of the final exam, to all members of the advisory committee at least two weeks prior to the exam.

A unanimous vote of approval of the advisory committee is required to pass the oral examination. Approval of the examination may be conditional, however, upon completion of additional work to the satisfaction of the advisory committee. A formal reexamination will not be required in this case. Failure of a student to pass the oral examination terminates the student's graduate work at North Carolina A&T State University, unless the graduate advisory committee unanimously recommends a reexamination. Only one reexamination will be given. A form giving the date that the exam was conducted and the result of the examination, signed by all members of the advisory committee, is forwarded to the Dean of the School of Graduate Studies by the Coordinator of Graduate programs in the student's department or program. A student may appeal all committee actions by written application to the Dean of the School of Graduate Studies.

Oral examinations for master's degree candidates are open to the Graduate Faculty by right and to the University community by unanimous consent of the advisory committee and the student being examined. Discussions and decisions regarding the student's performance are private to the advisory committee.

Summary of Procedures for Master's Degrees

ALL STUDENTS

- Application materials and required fees must be received.
- Application materials must be reviewed by department or program.

- The department or program must forward its recommendation regarding applicant's admissibility to the Dean of the School of Graduate Studies.
- The School of Graduate Studies must review the recommendation and the student is notified of the action taken on the request for admission.
- The student must report to the department or program, be assigned a graduate advisor, and develop a roster of courses and credits with the advisor.
- The student must comply with requests from the School of Graduate Studies for updated copies of transcripts from previous colleges or universities.
- The student must sign a patent agreement and file with the School of Graduate Studies.
- The student is subject to continuous registration policy until graduation.
- The student must pass a language examination, if required.
- The student must pass a written examination, if required.
- The student must submit a diploma order form by end of the sixth week of the semester or summer session of anticipated graduation.
- An overall grade point average of at least 3.0 must be maintained for all graduate coursework taken at North Carolina A&T State University to graduate.

All degree requirements must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the department/program or academic college/school.

Students in Non-Thesis Programs

- A graduate advisory committee of three or more Graduate Faculty members must be appointed by the Coordinator of Graduate Programs.
- A Plan of Graduate Work must be prepared by the student, in consultation with and with the approval of his/her graduate advisory committee. This plan must be approved by the Coordinator of Graduate Programs prior to completion of one-half the credits on the plan.
- When all requirements except completion of the course work in the final semester are satisfied, the Coordinator of Graduate Programs must request that the School of Graduate Studies issue a permit to schedule the final oral examination.
- If the School of Graduate Studies requirements are met, a permit to schedule the final examination will be issued within 20 working days of receipt of the request.
- The final examination must be scheduled and conducted.
- The final examination report, including date and result of the examination, must be submitted to the School of Graduate Studies by the Coordinator of Graduate Programs. This report should be received within five working days of the examination.

Students in Thesis Programs

- graduate advisory committee of three or more Graduate Faculty members must be appointed by the Coordinator of Graduate Programs.
- A Plan of Graduate Work must be prepared by the student, in consultation with and with the approval of his/her graduate advisory committee. This plan must be approved by the Coordinator of Graduate Programs prior to completion of one-half the credits on the plan.
- A copy of a preliminary draft of the thesis, if required, must be submitted to the chair of the student's advisory committee.
- When all requirements except completion of the course work in the final semester are satisfied and after the thesis is complete except for such revisions as may be necessary as a result of the exam, the Coordinator of Graduate Programs will request that the School of Graduate Studies issue a permit to schedule the final oral examination.
- If all requirements are met, a permit to schedule the final examination is issued by the School of Graduate Studies within 20 working days of receipt of the request.
- At least two weeks prior to the final oral examination, the chair of the student's advisory committee must submit the thesis to the other members of the advisory committee for review.
- The final examination must be scheduled and conducted.
- The final examination report, including the date and result of the examination, must be submitted to the School of Graduate Studies by the Coordinator of Graduate Programs. The report should be received by the School of Graduate Studies within

five working days after the examination.

- The student must submit four copies of the thesis, signed by each member of his/her advisory committee, to the School of Graduate Studies.
- The deadline date for submitting four copies of the thesis to the School of Graduate Studies for the student to graduate in a given semester or summer session appears in The Academic Calendar in this catalog as well as in other School of Graduate Studies calendars.
- The defended thesis is reviewed by the School of Graduate Studies to ensure that the format conforms with the specifications prescribed in the *Thesis and Dissertation Manual*.

Requirements for Doctor of Philosophy Degree

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work at the highest levels without supervision. The degree is, therefore, not granted simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. The student must demonstrate this ability by writing a dissertation reporting the results of an original investigation and by passing a series of comprehensive examinations in the field of specialization.

Advisory Committee and Plan of Graduate Work

An advisory committee of at least four Graduate Faculty members, one of whom will be designated as chair, will be appointed by the Dean of the School of Graduate Studies upon the recommendation of the Chairperson of the department. The committee, which must include at least one representative of the minor field, will, with the student, prepare a Plan of Graduate Work that must be approved by the department and the School of Graduate Studies. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan. Any subsequent changes in the committee or dissertation subject or in the overall plan must be submitted for approval as with the original plan. The program of study must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor.

Residence Requirement

For the Doctor of Philosophy degree, the student is expected to be registered for graduate work at an accredited graduate school for at least six semesters beyond the baccalaureate degree.

The basic University residence requirements are defined below. However, the College of Engineering has the prerogative of establishing more restrictive requirements within the respective programs.

Language Requirement

The departments may designate that the language requirement be fulfilled from among those languages in which the Department of Foreign Languages and Literatures conduct testing. Doctoral students should contact the major department for specific language requirements.

Preliminary Comprehensive Examinations

After completing the language requirement, but not earlier than the end of the second year of graduate study, and not later than one semester (four months) before the final oral examination, each doctoral student is required to take the preliminary comprehensive examination. The examinations consist of two parts: written examination and an oral examination.

The written portion may be conducted in one of two ways. In the first, each member of the advisory committee prepares a set of questions for the student's response, and answers to each set are returned to the appropriate member for grading. In the second, the Department prepares a single exam that is graded by a faculty committee.

The examination questions involved may cover any phase of the course work taken by the student during graduate study or any subject logically related to an understanding of the subject matter in the major and minor areas of study. The questions are designed to measure the student's mastery of the subject matter and the adequacy of preparation for research. Failure to pass the written preliminary examination terminates the student's work at this institution, subject to departmental and/or school policies with respect to reexamination.

Upon satisfactory completion of the written portion of the preliminary examinations and after completion of all course work relevant to the examination, authorization for the preliminary oral examination is requested from the School of Graduate Studies. This examination is conducted by the student's advisory committee and a representative from the School of Graduate Studies and is open to all Graduate Faculty members. The oral examination is designed to test the student's ability to relate factual knowledge to specific circumstances, to use this knowledge with accuracy and promptness, and to demonstrate a comprehensive understanding of the field of specialization and related areas.

A unanimous vote of approval by the members of the advisory committee is required for the student to pass the preliminary oral examination. Approval may be conditional, however, on the successful completion of additional work in some particular field(s). All committee actions may be appealed by written application to the Graduate Dean.

Failure to pass the preliminary oral examination terminates the student's work at the University unless the examining committee recommends a reexamination. No reexamination may be given until at least one full semester has elapsed, and only one reexamination is permitted.

Candidacy

A doctoral student is admitted to candidacy upon passing the preliminary examinations without conditions or after fulfilling any conditions specified by the advisory committee.

Qualifying Examination

This is a written examination that is required of all Ph.D. students and is scheduled each semester. The qualifying examination must be passed prior to the end of the third semester. Provisional students cannot sit for the qualifying examination. They must first gain a status change to unconditional admission. Students should consult the departmental handbook for details.

Preliminary Examination

The preliminary examination is given in the semester following completion of all required coursework. In this oral examination, the student is asked about graduate course work and subject matter related to the specialization. It is also a presentation and defense of the proposed dissertation topic. Students should consult the departmental handbook for details.

Admission to Candidacy

Admission to candidacy is given once the student has completed and passed all parts of the preliminary examination. Students should consult the departmental handbook for details.

Final Oral Examination

The final oral examination is scheduled after the dissertation is complete. It consists of the defense of the methodology used and the conclusion reached in the research. Students should consult the departmental handbook for details.

Dissertation Submission

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must be a contribution to knowledge, must be adequately supported by data and must be written in a manner consistent with the highest standards of scholarship. Publication is expected.

Upon passing the Ph.D. final oral examination, each Ph.D. student must have the dissertation approved by each member of the student's advisory committee. The defended dissertation must be submitted to the School of Graduate Studies by the deadline given in the academic calendar, and must conform to the School of Graduate Studies' *Thesis and Dissertation Manual*, a copy of which may be obtained from the School of Graduate Studies Office. Once final approval is granted, four copies of the document signed by all members of the student's advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

Residence Requirement and Doctor of Philosophy Time Limit

Two semesters of residence credits must be earned. In addition, the doctoral student has a maximum of six calendar years from admission to attain candidacy and ten calendar years to complete all requirements. The dissertation must be completed in five years after admission to candidacy. Students should consult the departmental handbook for details.

Credit Completion Requirements

A minimum of 24 course credits and 12 dissertation credits beyond the Master of Science are required. Students should consult the departmental handbook for details.

Interinstitutional Doctor of Philosophy Program

North Carolina A&T State University, North Carolina State University and the University of North Carolina at Charlotte all participate in an interinstitutional Ph.D. program. Students seeking admission to such a cooperative program must satisfy all admission and degree requirements at the university where the Ph.D. will be issued as well as those of the student's home institution. Details are available at each of the departments involved in the interinstitutional Ph.D. program.

Summary of Procedures for Doctor of Philosophy

- Application materials and the required fee are received.
- Application materials are reviewed by the department or program.
- The department or program forwards its recommendation regarding applicant's admissibility to Dean of the School of Graduate Studies
- The School of Graduate Studies reviews the recommendation and notifies the student of the action taken on the request for admission.
- The student arrives, reports to the department or program, is assigned a graduate advisor, and develops a roster of courses and credits with the advisor.
- The student complies with requests from the School of Graduate Studies for updated copies of transcripts from previous colleges or universities.
- The student is subject to the continuous registration policy until graduation.
- An advisory committee of at least four graduate faculty members is appointed by the Dean of the School of Graduate Studies upon the recommendation of the coordinator of graduate programs.
- The Dean of the School of Graduate Studies appoints a representative to the student's committee.
- A dissertation subject is selected and an outline of the proposed research submitted to the student's advisory committee and the coordinator of graduate programs for review and approval. A Plan of Graduate Work is prepared by the student, in consultation with and with the approval of his/her graduate advisory committee and the coordinator of graduate programs, and forwarded to the School of Graduate Studies for approval as soon as feasible after completion of 12 hours of course work.
- Written examinations in the major and minor fields are scheduled no earlier than the end of the second year of graduate study and not later than one semester before the final oral examination.
- When all written examinations have been completed satisfactorily, the chair or the coordinator of graduate programs requests the scheduling of the preliminary oral examination at least two weeks prior to the suggested date.
- The report of the examination is sent to the School of Graduate Studies and if, the examination has been passed without conditions, the student is admitted to candidacy.
- A copy of the preliminary draft of the dissertation is submitted to the chair of the student's advisory committee for review.
- At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the dissertation to advisory committee members for review. A copy is submitted to the School of Graduate Studies representative at least one week prior to the exam.
- One semester or its equivalent after admission to candidacy or later, after the dissertation is complete except for such revisions as may be necessary as a result of the final examination, and at least two weeks prior to the suggested date, the student's advisory committee chair or the director of graduate programs requests the scheduling of the final oral examination. Upon approval of the request, the student and the examining committee, including the Graduate School representative, are notified of

the time and place of the examination.

- Results of the final oral examination are forwarded to the School of Graduate Studies.
- Upon the student's passing the final oral examination, four copies of the dissertation signed by each member of the student's advisory committee and five copies of the abstract must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. One copy each of the University Microfilms Agreement, the Survey of Earned Doctorate, and the Graduate School Exit Survey forms must be completed and submitted with the dissertation.
- The defended dissertation is reviewed by the School of Graduate Studies to ensure that the format conforms to the specifications prescribed in the *Thesis and Dissertation Manual*.
- All course work scheduled in a graduate degree classification must be completed prior to graduation.
- A grade point average of at least 3.0 for the degree requirements as well as on overall graduate course work at North Carolina A&T State University is required for graduation.
- The doctoral residence requirement must be satisfied. All degree requirements must be completed within ten years from admission to the doctoral program.

THE NORTH CAROLINA A&T STATE UNIVERSITY LIBRARY

Ferdinand Douglass Bluford Library

Ferdinand Douglass Bluford Library is located near the center of the West campus. The current holdings include more than 566,000 bound volumes, over 34,000 e-books, and as a select depository in North Carolina for United States government documents, the library contains a collection of over 276,000 official government publications. Current serials include approximately 40,089 print and electronic subscriptions. Other holdings include a collection of videotapes, microforms, and other audiovisuals. The Library maintains special collections in Archives, Black Studies and Teacher Education materials.

Special services are provided through formal and informal library instructional programs, document delivery, interlibrary loans, and laptop checkouts. During the academic year, the library is open each week as shown below. Variations in this schedule are posted at the front entrance of the library.

Sunday – 2:00 p.m. with 24-hour service until Friday, 8:00 p.m.

Saturday – 10:00 a.m.-7:00 p.m.

OFFICE OF SUMMER SESSIONS AND OUTREACH

The **Summer Sessions** are an integral part of the regular University program and are administered by the regular staff augmented in several fields by visiting faculty. The standards of academic achievement, including the courses and the quality of work required in them, are maintained at the same level as during the regular terms. Credits obtained and times spent are recognized fully toward meeting residence requirements for graduation.

Students interested in attending a Summer Session must complete a separate application and have a current year FAFSA on file. Students generally receive the Pell Grant and/or the Federal Direct Student Loan, if there is remaining eligibility. All students must attend the first, dual sessions or first and second sessions to be eligible for aid. A student must be enrolled at least half-time to receive loan assistance.

The Summer Sessions consist of two 5-week sessions, one 10-week session and one two-week session, with short courses and workshops offered at various times throughout the sessions. This program provides daily summer study to meet the needs of graduate and undergraduate degree-seeking students, teachers, and other professionals, or any other persons whom summer study will benefit in the attainment of their educational goals. Persons who have not been accepted into the School of Graduate Studies, but wish to take courses in a Summer Session, must complete an application and pay the application fee before registering for the course.

The **Outreach** component seeks to provide a broad base of support, through collaborative initiatives with the various units on the campus, for pre-college activities for youth that support learning, discovery and engagement in the greater university community. The Office partners with public and private schools in and

around the Greensboro area in order to support teacher training and promote interdisciplinary learning experiences at all levels.

OFFICE OF CONTINUING STUDIES

The Office of Continuing Studies provides the administrative structure and coordination of extension credit courses, conferences, workshops, and short courses. The staff works with faculty and community groups to develop learning activities to meet the educational needs of individuals or groups. Special emphasis is given to technical certification programs leading to certification in several fields.

MAJOR RESEARCH CENTERS AND INSTITUTES

Center for Aerospace Research

The primary mission of the Center of Aerospace Research is to conduct high quality research in aeronautics and astronautics. The core research themes are Aerospace Structures, Controls, and Guidance; Computational Fluid Dynamics; Propulsion; and Human-Machine Engineering. The education component supports an aerospace option in the mechanical engineering curriculum. The Center performs critical research that contributes to the development of technology necessary to support the development of NASA's High Speed Civil Transport programs and the improvement of the Single and Two State to Orbit missions. Ongoing research efforts are directed towards the support of NASA's exploration of space and long-term human presence in space, as well as enhancement of life of Earth. Researchers are actively developing capabilities in the areas of space station design and management and micro-gravity materials research.

Center for Electronics Manufacturing

The goal of the Center is to strengthen the manufacturing, service, and research arm of the electronics manufacturing industry with respect to productivity, quality, and timeliness of product and service delivered. Specifically, the Center focuses on (a) the need to reduce time to service or market, (b) the need to access leading manufacturing technologies while reducing investments, (c) the need to focus on core competencies, and (d) the need to improve inventory management and purchasing power. This program develops expertise in each of the areas of electronics, manufacturing, safety, the environment, design, quality, computing, and management.

Center for Composite Materials Research

Research with polymeric-based composite materials at North Carolina A&T State University was started in 1976. The present Center was established in 1988 formally as a center of excellence in composite materials. The major facilities are the Computational Laboratory, Mechanical Testing Laboratory, Diagnostic Laboratory, and Composite Processing and Fabrication Laboratory. Research activities are focused on (a) processing and fabrication of simple to complex composite components (autoclave, compression molding, resin transfer molding, and composite structural components); (b) use of textile fiber architectures in the fabrication of non-trivial light weight composite components (braids, plain weaves, etc.); (c) testing and characterization of composite materials; (d) analysis of composite structural components; (e) study of cost-effective near net-shaped composite components; (f) development of innovative processing techniques with textile fabrics (small ablative nozzles, integrally blade-stiffened panels, box sections, etc.); and (g) training of students and engineers from industry in the fabrication and use of composites.

Center for Advanced Materials and Smart Structures

The Center for Advanced Materials and Smart Structures (CAMSS) is an educational and research resource for the State of North Carolina and the nation in the field of advanced ceramic materials and their composites. It is a collaboration of academe, private industry and the government in developing basic and applied research programs with a focus on an integration of research and education. The Center's interdisciplinary and integrated approach provides a rich collection of outcomes for the institutions involved and for the engineering infrastructure in general. Basic research in the technical thrust areas (advanced ceramics, advanced composites, electronic ceramic devices, sensors and smart structures and III-V

nitrides, ohmic contacts and devices) drives the Center's activities.

Center for Energy Research and Technology

The mission of the Center is to enhance undergraduate and graduate education through energy-related research and to transfer this new knowledge to regional and national industries. The objective is to improve economic competitiveness while reducing the environmental impact that results from excessive energy consumption. The research focuses on energy use and energy efficiency in buildings and industrial processes as they relate to technological, economic, political and environmental issues.

Civil Infrastructure Research Institute

The Institute conducts materials characterization, materials testing, load modeling, and structural health and durability research on concrete pavement materials and aircraft runway paving structures. The objective is to determine full-scale validation of airport pavement using field instrumentation and computer simulation, more accurate evaluation of asphalt and concrete elastic and visco-elastic properties, and more accurate simulation of the loading of new, heavier airplanes' landing gear on airfield pavements. Its major research efforts are concentrated at the Piedmont Triad International Airport in preparation for the proposed FedEx Mid-Atlantic Hub, but other focus areas are (1) the structural health and durability of bridges and highways and (2) dredging technology.

Institute for Human-Machine Studies

The field of human-machine system engineering emphasizes how users interact with machines, how usable machines are to users, and the impact of machines on user performance. The Institute is a comprehensive multi-disciplinary program of basic and applied scientific research and technology development directed toward the understanding of the nature of human performance while interacting with complex technology-driven systems. It focuses on cognitive engineering and human-system interface sciences, aviation and transportation human factors, information and communication technology integration, and healthcare and manufacturing applications.

Interdisciplinary Center for Entrepreneurship and E-Business

The Interdisciplinary Center for Entrepreneurship and E-Business (ICEEB) is dedicated to developing the entrepreneurial spirit at North Carolina A&T State University. The ICEEB provides academic and experiential learning experiences for students interested in individual or corporate entrepreneurship and for local entrepreneurs interested in improving their businesses. The center's main goals are to promote entrepreneurship as a career option, to increase student participation in e-business, to provide an entrepreneurial environment and opportunities for students to successfully start their entrepreneurial careers, and to encourage and support research in entrepreneurship and e-business. ICEEB is a joint project of the School of Business and Economics, the School of Agriculture and Environmental Sciences, and the School of Technology. Located in the School of Business and Economics, the center collaborates with various schools and colleges to offer students the Certificate in Entrepreneurship, an Entrepreneurship Mentoring Program, a Virtual Incubator, a Business Plan Competition, the Entrepreneurial Internship, and a Lecture Series.

Center for Autonomous Control and Information Technology

The areas of concentration are soft computing, multiagent systems, artificial intelligence in general, control theory, genetic algorithms, and energy conservation and power electronics. The Center conducts interdisciplinary research in demonstrative programs for the application of fuzzy logic-controlled power electronic building block systems in HVAC systems, nonlinear active control of dynamic systems, artificial potential field based motion planning/navigation in two- and three-dimensional dynamic environments, and other relevant topics.

North Carolina Agromedicine Institute

The NC Agromedicine Institute is a scientifically based organization whose focus is on environmental and occupational health and safety issues of agricultural, forestry, and fisheries producers, workers and their families. Its mission is to promote the health and safety of agricultural, forestry, and fisheries communities through research, education, and outreach.

Center for International Trade

The primary mission of the Center is to stimulate economic development and international trade. The educational activities are principally aimed at teaching students and providing research and related materials to small businesses as well as technical assistance and information to the agricultural business community. Program emphases include (a) developing educational programs to enable farmers and processors to produce a broader range of products to boost local economic performance; (b) identifying alternative markets; (c) enhancing understanding of the linkages among national economies, world markets, and agriculture; (d) conducting market-based research to understand factors that influence competitiveness; (e) educating producers, processors, and other clients about trade policies, regulations, and world economic and political trends affecting U.S. trade competitiveness; and (f) developing programs of North Carolina's rural communities to enhance entrepreneurial skills, create jobs, and diversify their economies.

Transportation Institute

The mission of the Transportation Institute is to coordinate and manage interdisciplinary research, training, and technology transfer activities involving faculty, staff and students from various departments within the University. The activities of the Institute include soliciting extramural funding; coordinating faculty development and student enrichment programs; facilitating technology transfer; providing technical assistance and public service; and coordinating other transportation related programs. The Transportation Institute functions as a national and regional center for research and training and as an information clearinghouse.

Waste Management Institute

The Waste Management Institute is an interdisciplinary program that is designed to enhance awareness and understanding of waste management problems in our society and to enhance instruction, research, and outreach aimed at improving the quality of life and protecting the environment. The goals of the Institute are to increase the number of professionals in environmental and waste management, to enhance interdisciplinary research, to increase public awareness, and to facilitate cooperative and exchange programs among students, faculty, government, and industry.

National Institute of Aerospace

The Institute conducts and promotes leading-edge aerospace and atmospheric sciences research and develops innovative new technologies in the following seven technical areas: (1) revolutionary aerospace systems, concepts and analysis; (2) planetary capture and entry technology; (3) aerodynamics, aerothermodynamics, and acoustics; (4) structures and materials; (5) airborne systems; (6) atmospheric and vehicle sensor system technology; and (7) atmospheric chemistry and radiation science.

SERVICES PROVIDED BY THE DIVISION OF INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS (IT&T)

The Division of Information Technology and Telecommunications (IT&T) at North Carolina Agricultural and Technical State University Provides assistance to faculty, students, staff, and the community for promoting curricula development, new learning environments powered by technology, administrative and student support services and research activities. IT&T delivers academic and administrative support services by using the power of information technology to create and sustain a learner- centered community.

The Division of Information Technology and Telecommunications is divided into ten areas: Academy for Teaching and Learning (ATL), Administrative Information Systems (AIS), Center for Distance Learning (CDL), Research Computing (RC), Special Projects and Programs (SPP), Student Technical Services (STS), Systems and Networking (SN), Teaching and Learning Systems (TLS), Telecommunications & Client Services (TCS) and Web Support Services (WSS). In addition, IT&T provides media services to the learner-centered community of Greensboro and the surrounding areas through three major information delivery methods that include WNAA-FM Radio Station, The Campus Television Studio, and five video conferencing sites. WNAA-FM Radio provides on-air educational, cultural and entertainment programs to the learner-centered community of Greensboro and the surrounding areas. The station's cultural, educational and entertainment programs serve as a venue for faculty, students and staff to develop and showcase their creative work, skills and talents to the community as subject area experts. The Television Studio located in Crosby Hall is a major instructional

video production center for faculty and students. It serves as a training site for communications majors and produce special event video projects for the university as well as promotional tapes, multicamera productions of theatrical plays and coverage of Honors' Day Convocation and commencement activities. To date, the University has five electronically connected videoconferencing sites for delivering voice, video and text simultaneously. McNair Hall, Center for Distance Learning, the Academy for Teaching and Learning, Smith Hall and Stallings Memorial Ball Room are connected with videoconferencing units that have multi-site and natural video functionality. The videoconferencing sites create a collaborative information dissemination system for enhancing faculty research and teaching along interdisciplinary lines by allowing both students and faculty from every discipline to interface with programs and activities shared through internet-satellite videoconferencing. The sites also provide administrative support services through workshops, seminars and conferences that are shared with other institutions of higher education, government agencies and philanthropic organizations.

The **Directorate of the Academy for Teaching and Learning (ATL)** is responsible for promoting and coordinating the scholarship of teaching and learning through effective use of pedagogy with learning technologies. ATL provides instructional consultation, classroom and laboratory observation, assessment and evaluation of instruction, and conducts action research. In addition, ATL implements various technologies in delivering instruction such as distance learning, teleclassrooms, teleconferences, and videotaping of instruction.

The **Directorate of Administrative Information Systems (AIS)** is responsible for central administrative computing and related information management activities for the University. AIS develops, maintains, and/or provides technical support for the campus financial, human resources, alumni and student information systems as well as appropriate computing for other administrative functions in academic and administrative units.

AIS support the University's mission of instruction, research, and public service by implementing, enhancing, and supporting administrative systems. AIS' focus is easy access to secure, reliable, and timely data. AIS is committed to retaining quality staff, investigating new technologies, and partnering with others to provide technical leadership and effective solutions.

The **Center for Distance Learning (CDL)** is responsible for both traditional and non-traditional students in implementing programs and courses to meet their educational needs without extended stays on campus. Courses are offered at a distance through online and extension programs. Students and instructors can interact via online discussion groups, email, streamed videos, and on-site instruction. CDL serves as a mechanism by which North Carolina Agricultural and Technical State University can achieve its academic goals by developing innovative instructional programs that will meet the needs of a diverse student population.

The **Directorate of Research Computing (RC)** supports a variety of services aimed at improving the quality of research through the application of technology. The services consist of providing installation, operation and maintenance of information systems labs, electronic collaboration, technical support of research projects and consulting services.

Additionally this includes optimized utilization and operational enhancements of the computing requirements for improving our research infrastructure. This will also allow an interdisciplinary approach for centralization of information sharing and supplying systems for supercomputing, computational modeling/analysis, e-learning, genomics, bio-informatics, and other research opportunities. For additional information please visit the website: <http://dor.ncat.edu/under/facts/people/marlow/index.htm>.

The **Directorate of Special Projects and Programs (SPP)** coordinates the planning efforts of special projects to improve IT efficiency and effectiveness in various administrative operations. SPP provides project management services in collaboration with all functional areas of the Division of Information Technology & Telecommunications and end-users for special projects. SPP also provides ad-hoc reporting for the University's Financial Records System (FRS).

The focus of the **Directorate of Student Technology Services (STS)** is to enhance information technology support for the University and surrounding community through the employment and professional development of North Carolina A&T students. STS will also provide IT Procurement. IT procurement consists of assisting the University community with information technology acquisitions while further developing standards, processes, and vendor relationships in this area.

The **Directorate of Systems and Networking (SN)** is responsible for the day-to-day management of the academic and administrative computing systems that support the University's mission critical applications. This includes ensuring that the equipment and the supporting network infrastructure are fully functional and readily available.

The **Directorate of Teaching and Learning Systems (TLS)** is charged with professional

development and training activities of the University with regard to technology proficiency. In addition, this directorate is responsible for project management associated with the university's e-learning platform, Blackboard.

The **Directorate of Telecommunications and Client Services (TCS)** covers two areas. The *Telecommunications Services* department is responsible for providing effective voice communication service for the university faculty, staff, and student populations. It includes the installation/administration/maintenance of services such as voice mail, cellular, calling card, pagers and pay phones.

Client Services is responsible for providing helpdesk services in information delivery, problem management, and technical troubleshooting for recommended computers and software packages for campus personal computer users. Client Services also determines the standards for computer hardware, software, and related equipment to ensure that such equipment is appropriate for the University's computing environment. For additional information please visit the website: <http://www.ncat.edu/~cit/csv>.

The **Directorate of Web Support Services (WSS)** addresses website development and communication needs of faculty, staff and students at North Carolina A&T State University by using website development and management tools to provide web-based applications. WSS also uses these tools to share information about the many activities and facets of the University with the online community. WSS also provides opportunities for continued education and skill development for the University community through skills development workshops.

FIELDS OF INSTRUCTION

This section identifies and gives pertinent information about all the fields of study that participate in graduate education at North Carolina A&T State University. There are a total of 40 different fields offering graduate degrees. In addition, there are nine fields that offer minors at the graduate level and eleven areas that support graduate education through offering graduate level courses or in some other capacity. Fields of instruction that offer graduate degrees are listed first. Information given for each field includes the faculty, requirements for admission to and completion of the degree program(s), student financial support, courses offered, and other relevant information. Following the degree offering fields is a listing of other fields of instruction which offer graduate minors or graduate courses, or support graduate education in some other way. To avoid duplication, basic Graduate School requirements for admission and completion of graduate degree programs are not duplicated for each field of instruction. Only those requirements that are unique to the field are given in the sections on the individual fields. The Graduate School offers major programs of study in the following fields.

DEGREES GRANTED

The School of Graduate Studies at North Carolina A&T State University offers the following degrees:

DOCTOR OF PHILOSOPHY (Ph.D.)

1. Electrical Engineering
2. Energy and Environmental Studies (Interdisciplinary)
3. Industrial Engineering
4. Leadership Studies (Interdisciplinary)
5. Mechanical Engineering
6. Industrial Management (*Consortium Degree Program w/ University of Indiana*)

MASTER OF ARTS (M.A.)

College of Arts and Sciences

1. English and African American Literature

MASTER OF ART IN EDUCATION

School of Education

1. Reading Education

MASTER OF ART IN TEACHING

School of Education

1. Elementary Education, General
2. Special Education

MASTER IN SCHOOL ADMINISTRATION (M.S.A.)

School of Education

1. School Administration

MASTER OF SCIENCE (M.S.)

School of Agriculture and Environmental Sciences

1. Agribusiness, Applied Economics and Agriscience Education
 - a. Agricultural Economics
 - b. Agricultural Education
2. Animal Health Science
3. Food and Nutritional Science
4. Plant and Soil Science

College of Arts and Sciences

1. Biology
2. Biology, Secondary Education
3. Chemistry
4. Chemistry, Secondary Education
5. English, Secondary Education
6. History, Secondary Education
7. Mathematics, Applied
8. Mathematics, Secondary Education
9. Physics

School of Education

1. Adult Education
2. Counselor Education
3. Elementary Education
4. Physical Education
5. Human Resources (Agency Counseling)
6. Human Resources (Rehabilitation Counseling)
7. Instructional Technology

College of Engineering

1. Civil and Environmental Engineering
2. Chemical Engineering
3. Computer Science
4. Electrical and Computer Engineering
5. Industrial and Systems Engineering
6. Mechanical Engineering

School of Technology

1. Construction Management and Occupational Safety and Health
 - a. Construction Management
 - b. Environmental and Occupational Safety and Health
 - c. Occupational Safety and Health
2. Electronics and Computer Technology
 - a. Electronics and Computer Technology (MSIT)
 - b. Information Technology (MSIT)
3. Graphic Communication Systems and Technological Studies

- a. Graphic Communication Systems (MSIT)
 - b. Technology Education, Teaching
 - c. Trade and Industrial Education, Teaching
 - d. Training and Development for Industry
 - e. Workforce Development Director
4. Manufacturing Systems
- a. Manufacturing Systems (MSIT)

MASTER OF SCIENCE IN MANAGEMENT (M.S.M.)

School of Business and Economics

- 1. Human Resources Management
- 2. Management Information Systems
- 3. Transportation and Business Logistics

**Agribusiness, Applied Economics
and Agriscience Education**

Anthony K. Yeboah, Chairperson
(336) 334-7943
yeboaha@ncat.edu

OBJECTIVES

The Department of Agribusiness, Applied Economics, and Agriscience Education offers programs of study leading to the Master of Science degrees in Agricultural Economics and Agricultural Education. The program in Agricultural Economics prepares students for careers in teaching, research, extension, agriculture-related business, and government service. The program in Agricultural Education emphasizes the professional improvement of teachers and professional workers in related areas with education responsibilities while concurrently preparing students for employment in administration, supervision, extension, teacher education, business, and research in agricultural education and related fields. Both programs also prepare students for further graduate studies to achieve a terminal degree.

DEGREES OFFERED

Master of Science -Agricultural Education

Concentrations: Professional Licensure, Professional Service

Master of Science -Agricultural Economics

Concentrations: Agricultural Marketing and International Trade; and Rural Development Policy

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution, with a minimum grade point average of 2.65 (on a 4.0 scale) and a basic preparation in Agricultural Education, Education, General Agriscience, Agricultural Economics, Economics, Agribusiness or Business Administration, with a preparation in Economics/Statistics, generally will provide an acceptable preparation. Applicants who do not meet the requirements will be considered on an individual basis. Applicants are encouraged to provide GRE scores; however, these scores are not required for admission or graduation. A GPA of 3.0 is required for graduation.

PROGRAM REQUIREMENTS

Agricultural Economics:

The Master of Science in Agricultural Economics requires that the students complete one of two options:

1. THESIS OPTION - 30 Hours:

This option requires a minimum of 30 semester hours, including 12 semester hours of “core” courses in advanced economic theory, a course in statistics and research methods, 9 semester hours of courses in the selected program track/**concentrations**, 1 elective 3-hour course, and 6 semester hours of thesis culminating in scholarly research work. In addition, the successful completion and defense of the thesis and a comprehensive examination are required.

2. NON-THESIS OPTION - 30 Hours:

This option consists of a minimum of 30 semester hours, including 15 semester hours of “core” courses in advanced economic theory, a course in statistics, econometrics and research methods, 9 semester hours of courses in the selected program track, 1 elective 3-hour course, and 3 semester hours of a scientific project. This non-thesis option recognizes the changes within the agricultural economics discipline relative to the manner in which research is conducted and reported such that it becomes more applied, action-oriented and evaluative. The student may choose to complete an econometrics project or an issues based project. In addition, the successful completion and defense of the project paper and a comprehensive examination are required.

The student pursuing the Master of Science degree in Agricultural Economics/
Agribusiness is required to complete a common core of courses consisting of:

AGEC 705	Advanced Statistics	3 Semester Hours
AGEC 710	Advanced Microeconomics	3 Semester Hours
AGEC 720	Advanced Macroeconomics	3 Semester Hours
AGEC 725	Research Methods	3 Semester Hours

or

AGED 703	Scientific Methods of Research	3 Semester Hours
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In addition, areas of concentration as specified require the following courses:

Rural Development Policy

Core Courses		12 Semester Hours
Program Track/<i>Concentration</i> Courses		9 Semester Hours

AGEC 708	Econometrics	3 Semester Hours
AGEC 732	Agricultural Policy	3 Semester Hours
AGEC 740	Production Economics	3 Semester Hours
AGEC 760	Social Organization of Agriculture and Rural Development	3 Semester Hours

Elective		3 Semester Hours
Thesis		6 Semester Hours

Total hours in concentration **30 Semester Hours**

Agricultural Marketing and International Trade

Core Courses		12 Semester Hours
Program Track/<i>Concentration</i> Courses		9 Semester Hours

AGEC 632	International Agricultural Trade Policy	3 Semester Hours
AGEC 634	International Agribusiness Marketing	3 Semester Hours
AGEC 734	Agricultural Marketing	3 Semester Hours
AGEC 735	Economic Development	3 Semester Hours
AGEC 736	Marketing Problems and Issues	3 Semester Hours
AGEC 738	Theory of International Trade	3 Semester Hours
AGEC 756	Agricultural Price Analysis	3 Semester Hours

Elective		3 Semester Hours
Thesis		6 Semester Hours

Total hours in concentration **30 Semester Hours**

- Notes:**
- 1. Students who select the non-thesis option must take three hours of AGEC 708 (Econometrics) and three hours of AGED 750 (Community Problems).**
 - 2. The student, in consultation with his or her advisor, will select three courses from the program track of interest.**

Agricultural Education:

Students seeking admission into agricultural education have a choice of two major study concentrations: Professional Licensure and Professional Service. The Professional Licensure track is designed for individuals who are currently teaching secondary agricultural education, holders of the "A" License for secondary agricultural education in the State of North Carolina, or those individuals who are within 12 hours of the "A" License. Students enrolled in the Professional Licensure Concentration are immersed in a curriculum based upon advanced competencies as mandated by the North Carolina Department of Public Instruction and

National Board for Professional Teaching Standards. Students enrolled in the Professional Licensure concentration have the option to pursue a thesis or non-thesis track. Upon completion of this concentration students are eligible for the “M” License in secondary agricultural education for the State of North Carolina.

Students choosing the Professional Service concentration have the opportunity to develop a plan of study, which will prepare them for careers in the broad areas of extension education, public relations, social capital development, curriculum design, adult education, program development and evaluation, agribusiness, as well as positions in agriscience research. The Professional Service Concentration consists of a thesis and non-thesis option.

Upon admittance into the graduate program in Agricultural Education the student is assigned an advisor who will guide him/her in the development of his/her graduate committee, plan of study, Product of Learning, and Educational Inquiry Project/Thesis. Completion of 37 semester hours of approved graduate level courses is required for both study concentrations. A well-balanced, unified, and complete program study will be required. In addition, those students who do not write a thesis must develop an educational inquiry project under the supervision of their graduate committee. The advisory committee will determine its nature and content. For those students who select the thesis option, they must complete 31 hours of approved graduate level courses and 6 hours of thesis credit. In both options students must successfully pass a written comprehensive examination in Agricultural Education to complete the degree program.

The student pursuing the Master of Science of Agricultural Education is required to complete a common core of courses consisting of:

Course Title		Credit
AGEC 705	Advanced Statistics	3
or		
CUIN 710	Educational Statistics	3
AGEC 725	Research Methods	3
or		
AGED 703	Scientific Methods in Research	3

COURSES IN AGRICULTURAL EDUCATION

Course Title		Credit
AGED 600	Youth Organization and Program Management	3
AGED 601	Adult Education in Vocational and Extension Education	3
AGED 607	Environmental Education	3
AGED 608	Agricultural Extension Organization and Methods	3
AGED 609	Community Analysis and Rural Life	3
AGED 611	Special Problems in Agricultural Education	1-6
AGED 612	Field Studies in Agricultural Education	1-6
AGED 700	Seminar in Agricultural Education and Extension	1
AGED 701	Professional Service Seminar	1
AGED 703	Scientific Methods in Research	3
AGED 704	History and Philosophy of Vocational Education	3
AGED 705	Advances in Agricultural Business and Science	3
AGED 708	Scientific Methods in Educational Research II	3
AGED 709	Study and Application of Technological Advances and Best Practices to Agriculture	3
AGED 710	Program Design, Management, and Evaluation	3
AGED 711	Advance Teaching and Assessment Methods	3
AGED 712	Government Policy Analysis and Agriculture and Problem Solving Techniques for Field Settings	3
AGED 750	Community Problems	3
AGED 751	Agricultural Education Across the Curriculum	3
AGED 752	Special Populations in Agricultural Education	3

AGED 753	Program Planning	3
AGED 754	History of Agricultural Education	3
AGED 795	Agricultural Industry Internship	4
AGED 796	Master's Non-thesis Project Seminar	1
AGED 797	Agricultural Education Program Management Plan Project	4
AGED 798	Seminar in Agricultural Education	1
AGED 799	Thesis Research	6

COURSES IN AGRICULTURALECONOMICS AND RURAL DEVELOPMENT

Course Title	Credit
AGED 632 International Agricultural Trade Policy	3
AGED 634 International Agribusiness Marketing	3
AGED-635 Economic Geography of World Food and Resources	3
AGED 638 Special Problems in Agricultural Economics	3
AGED 640 Agribusiness Management	3
AGED 641 Special Problems in Agribusiness Management	3
AGED 644 Statistical Methods in Agricultural Economics I	3
AGED 646 Statistical Methods in Agricultural Economics II	3
AGED 648 Appraisal and Finance of Agribusiness Firms	3
AGED 650 Human Resource Development	3
AGED 675 Computer Applications in Agriculture	3
AGED 705 Statistical Methods in Agricultural Economics	3
AGED 708 Econometrics	3
AGED 710 Microeconomics	3
AGED 720 Macroeconomics	3
AGED 725 Research Methods in Agricultural Economics	3
AGED 732 Agricultural Policy	3
AGED 734 Agricultural Marketing and Interregional Trade	3
AGED 735 Economic Development	3
AGED 736 Agricultural Marketing Problems and Issues	3
AGED 738 Theory of International Trade	3
AGED 740 Production Economics	3
AGED 756 Agricultural Price Analysis	3
AGED-760 Social Organization of Agriculture and Rural Development	3
AGED 799 Thesis Research	6 (6-0)

COURSES WITH DESCRIPTION IN AGRIBUSINESS, APPLIED ECONOMICS AND AGRISCIENCE EDUCATION

Advanced Undergraduate and Graduate

Agricultural Economics

AGED-632. International Agricultural Trade Policy **Credit 3 (3-0)**

This course includes a review of economic and welfare theory applications relative to trade of agricultural commodities. Topical issues include the analysis of linkages among commodity programs, fiscal and trade policies for the U.S. and other countries in an interdependent world, development of an understanding of international institutions and their role in formulating aliments of strategic agricultural trade policy. Prerequisite: Consent of instructor.

AGED-634. International Agribusiness Marketing **Credit 3 (3-0)**

This course will examine and analyze the series of problems, issues, policies, regulations and procedures relevant to the global marketing of agricultural and related commodities by agribusiness firms. Emphasis will be on combining firm-level agribusiness marketing concepts with international agribusiness marketing and export management practices, including the development of international agribusiness marketing plans and case studies from international agribusiness firms. Prerequisite: Consent of instructor.

AGED-635. Economic Geography of World Food and Resources **Credit 3 (3-0)**

The objective of this course is to acquaint students from across the University and hopefully those outside the University with the economics and geography of the world's human and natural resources as they affect food and fiber production, resource use, and economic welfare

around the world. Content is drawn from many disciplines that study the natural world and investigate forces that affect the availability of resources, the dynamics of populations, the behavior of people, and different nation's policies towards food, resource use, trade, and the environment. Initially, the course provides students with a basic tool kit of essential economics, geography, climatology, and history. Then these tools are used to compare and contrast different examples around the world. Finally, some critical resource use and environmental issues are introduced and applied to the examples. The overall theme of the course is on the hard decisions and trade-off necessary to meet growing needs with fixed resources in a stressed natural environment. Prerequisite: Consent of the instructor

AGEC-640. Agribusiness Management **Credit 3 (3-0)**
This course focuses on methods of research, plans, organization, and the application of management principles. Part of the student's time will be spent in consultation with agribusiness firms. Prerequisite: Consent of the instructor.

AGEC-641. Special Problems in Agribusiness Management **Credit 3 (3-0)**
This course relies heavily on case studies and simulation models to help make decisions and solve problems faced by agribusiness managers. Also, students will be exposed to quantitative techniques for analyzing and solving problems confronting the firm. Emphasis is placed on applying theoretical concepts to the real-world decision-making environment. Prerequisite: Ag. Econ 640 or consent of instructor.

AGEC-648. Appraisal and Finance of Agribusiness Firms **Credit 3 (3-0)**
This course evaluates principles of land valuation, appraisal and taxation. Special areas include the role of credit in a money economy, classification of credit, principles underlying the economic use of credit and the role of the government in the field of credit.

AGEC-650. Human Resource Development **Credit 3 (3-0)**
This course focuses on the analysis of human resources in relation to changing agricultural production technology in rural areas. Prerequisite: Consent of instructor.

AGEC-675. Computer Applications in Agricultural Economics **Credit 3 (3-0)**
This course is designed to provide students with the tools to utilize computers for agricultural decision-making. Emphasis will be placed on utilizing existing software packages for microcomputers and mainframe computers to make financial, economic and quantitative analysis of farm and agribusiness-related problems. Prerequisite(s): Ag. Econ. 330 or Econ. 330.

Agricultural Education

AGED-600. Youth Organization and Program Management **Credit 3 (3-0)**
Principles, theories and practices involved in organizing, conducting, supervising, and managing youth organizations and programs. Emphasis will be on the analysis of youth organization and programs in vocational and extension education.

AGED-601. Adult Education in Vocational and Extension Education **Credit 3 (3-0)**
A study of the principles and problems of organizing and conducting programs for adults. Emphasis is given to the principles of conducting organized instruction in agricultural education, extension, and related industries.

AGED-607. Environmental Education **Credit 3 (3-0)**
Principles and practices of understanding the environment and the interrelated complexities of the environment. The course will include a study of agricultural occupations related to the environment and materials that need to be developed for use by high school teachers of agriculture and other professional workers.

AGED-608. Agricultural Extension Organization and Methods **Credit 3 (3-0)**
Principles, objectives, organization, program development, and methods in cooperative extension.

AGED-609. Community Analysis and Rural Life **Credit 3 (3-0)**
Educational processes, structure and function of rural society, and the role that diverse organizations, agencies, and institutions play in the education and adjustment of rural people to the demands of modern society.

AGED-611. Special Problems in Agricultural Education and Extension **Credit 1-6 (1-6)**
Special work in problems dealing with Agricultural Education and Extension will be examined. Students should be at the graduate level or be working on their lateral or provisional license in agricultural education.

AGED-612. Field Studies in Agricultural Education **Credit 1-6 (1-6)**
Field Studies involved in Agricultural and Extension Education.

Graduate Students Only

Agricultural Economics

AGEC-705. Statistical Methods in Agricultural Economics **Credit 3 (3-0)**
Advanced topics on analysis of variance, regression, correlation, multistage sampling and probability are covered in depth. Prerequisite: Ag. Econ. 646.

AGEC-708. Econometrics **Credit 3 (3-0)**
This course focuses on the application of econometric techniques to agricultural economic problems, theory and estimation of structural economic parameters. Prerequisite: Ag. Econ. 705.

AGEC-710. Microeconomics **Credit 3 (3-0)**
Price theory and the theory of the firm are covered comprehensively. The decision-making units in our economy and their market relationship are also examined.

AGEC-720. Macroeconomics **Credit 3 (3-0)**
A continuation of aggregate economics, with emphasis upon measurement, growth and fluctuation of national income is the focus of this course.

AGEC-725. Research Methods in Agricultural Economics **Credit 3 (3-0)**
The philosophical bases for research methods used in agricultural economics are discussed. Alternative research methods are compared with respect to their dependence on the concepts of economic theory, mathematics and statistics. Alternative approaches to planning research projects are evaluated.

AGEC-732. Agricultural Policy **Credit 3 (3-0)**
Advanced analysis of the role of agriculture in the general economy and of economic, political and social forces which affect development of agricultural policy is the substantive focus of this course.

AGEC-734. Agricultural Marketing and Interregional Trade **Credit 3 (3-0)**
This course is designed to apply basic economic theory to interpret the essential components of the domestic and international marketing process for agricultural products. The primary focus will be on the spatial, temporal and form dimensional of market price analysis with significant emphasis on regional interrelationship and specialization, current trade issues and the rationale for trade. Specifically, students enrolled in this course will receive intensive instruction in the complex organization and function of the world's food marketing system.

AGEC-735. Economic Development **Credit 3 (3-0)**
This course is designed to analyze factors and issues involved in the process of economic growth and development, with emphasis on developing countries. The theories, problems, objectives and strategies of development, including major policy issues, resources, and constraints of alternative strategies are discussed. The role of capital, technology, agriculture and international trade in the development process are examined.

AGEC-736. Agricultural Marketing Problems and Issues **Credit 3 (3-0)**
This course is designed to examine current complex problems in agricultural marketing and methods of developing solutions.

AGEC-738. Theory of International Trade **Credit 3 (3-0)**
The principal aim of this course is to familiarize the student with the fundamental mechanisms and theory (pure and monetary) of international trade. Selected topics will include the law of

comparative advantage, gains from trade, factor endowments and growth theories, commercial policy, foreign exchange and the balance of payments, and the monetary and portfolio balance mechanisms. Prerequisite: Consent of instructor.

AGEC-740. Production Economics

Credit 3 (3-0)

This course focuses specifically on production economics theory in a quantitative framework. Technical and economic factor-product, factor-factor, and product-product relationships in single and multi-product firms under conditions of perfect and imperfect competition in both factor and product markets are topical areas.

AGEC-756. Agricultural Price Analysis

Credit 3 (3-0)

The use of price information in the decision-making process is the essence of this course. The relation of supply and demand in determining agricultural prices and the relation of prices to grade, time, location, and stages of processing in the marketing system are considered. The course also includes advanced methods of price analysis, the concept of parity and the role of price support programs in agricultural decisions. Prerequisite: Consent of instructor.

AGEC-760. Social Organization of Agriculture and Rural Development

Credit 3 (3-0)

The student will be introduced to socioeconomic concepts and theory as they apply to issues relating to agriculture and rural development. Moreover, the student can expect to learn about the different types of farm organizations; governmental agricultural agencies, farm movements, models of community organizations, and the changing structure of agriculture. The student will have a better insight about why some rural areas are growing and others are declining; how rural and urban areas are interdependent; how growth affects the distribution of income between income classes in these areas. Finally the student will gain an appreciation of how the different intellectual socioeconomic traditions explain the development of rural and urban economies and how to apply socioeconomic analysis in the discussion of federal, state and local policy for rural areas.

AGRI-799. Thesis

Credit 6 (6-0)

Agricultural Education

AGED-700. Seminar in Agricultural Education

Credit 1 (1-0)

A review of current problems and practices in the field of agricultural education and extension.

AGED 701. Professional Service Seminar

Credit 1 (1-0)

This course will prepare students for the entire Master's Program. Students will establish goals and objectives for their Master's Program. Students will also be introduced to the Professional Portfolio that is required of all Master's Students on the completion of their program.

AGED-703. Scientific Methods in Research

Credit 3 (3-0)

Methods of procedures in investigation and experimentation in education, accompanied by critical examination of studies made in agricultural education and related fields. A research problem is developed under the supervision of the staff.

AGED-704. Foundation and Philosophy of Agricultural Education

Credit 3 (3-0)

This advanced course deals with the development, organization, and philosophical foundations of agricultural education from colonial times to the present. Emphasis is placed on the role of societal and scientific changes, the federal government, and philosophy and its role in life including the rise of education in America, legislation having an impact on agricultural education, education in agriculture, and current issues in agricultural education on the evolution of agricultural education. Students will be expected to develop and defend their philosophy of agricultural education based on the foundations and philosophy of Agricultural Education. In addition to the above, students will be expected to research educational topics, critique the current research and present a seminar on their research topic.

AGED-705. Advances in Agricultural Business and Science

Credit 3 (3-0)

Students will review and study the literature on innovations in agribusiness/science practices, processes and product technologies. They will become knowledgeable and articulate about issues related to the role and contribution of science and research to agriculture over time, the development and diffusion of best practices, the impact of specific technological breakthroughs and basic techniques for assessing the efficacy of these.

AGED-708. Scientific Methods in Educational Research II **Credit 3 (3-0)**

This course covers advanced techniques in qualitative and quantitative research methodology focusing on the formulation of substantive research questions, problems or issues. Students will learn to apply a variety of educational research procedures such as ethnographic methodologies, evaluation research and case studies, qualitative choice models, nonparametric and parametric statistical methods and quasi-experimental techniques for field research and general linear models. Students will conduct, under the direction of the instructor, a research educational based project on their present agricultural educational experiences. Prerequisite: AGED 703.

AGED-709. Study and Application of Technological Advances and Best Practices to Agriculture **Credit 3 (3-0)**

This course provides students with an opportunity to observe and study the application of technological advances and best practices in a variety of settings in agriculture. In addition, students will work to develop a repertoire of skills and techniques that will enable them to select and apply innovations to their own educational settings, particularly the infusion of technology into the curriculum. The program will draw on the expertise of industry specialists and researchers, field trips and labs will provide hands-on experience. Prerequisite: AGED 705.

AGED-710. Program Design, Management, and Evaluation **Credit 3 (3-0)**

The planning, management and development of agricultural educational programs including needs assessment, objectives, development and content and materials selection. Evaluation of instructional programs; formative for program improvement and summative for outcomes accountability. Prerequisite: AGED 700.

AGED-711. Advance Teaching and Assessment Methods **Credit 3 (3-0)**

This course focuses on advanced concepts and methods relevant for both formal and informal agricultural education presentations, effects that methods may have on individuals involved in the learning experience and demonstrations of proficiency in use of various advanced methodologies, technologies and concepts. Students will focus on human learning development, diversity issues, motivational strategies to plan, use and evaluate student learning. Students will research and present projects based on the course of study. Students will keep a reflective journal based on the infusion of learning methods used in their educational occupations. Prerequisites: AGED 700 (701 for Professional Service Majors), 704, 709, 710.

AGED-712. Government Policy Analysis and Agriculture and Problem Solving Techniques for Field Settings **Credit 3 (3-0)**

Students will become conversant with basic principles, procedures, and phases of public policy formulation, analysis and decision making. Students will use agricultural issues/problem and policy as case studies to trace the evolution of an issue/problem/felt need into legislation or policy. Students will also learn basic techniques for analyzing policy impacts. Prerequisite: AGED 703.

AGED-750. Community Problems **Credit 3 (3-0)**

A study of the common problems of the community that relate to agriculture and related areas and of solutions for these problems.

AGED-751. Agricultural Education across the Curriculum **Credit 3 (3-0)**

This advance course will center on the application of curriculum development models, theories and processes in agricultural education. A large portion of the class will be devoted to the integration of agricultural curriculum into other subject areas such as Math, Science, English and History and the integration of other subject matter areas into agricultural education. Student will evaluate curriculum products and learn to modify curriculum to meet the needs of all students as well as reinforce other curricular areas. Students will see how content matter can be reinforced as it is taught across all curricular areas. Students will be expected to present a

project based on developing curricular plans and materials that address curriculum integration as related to agricultural education. Prerequisite(s): AGED 700 (701 for Professional Service Majors), 703, 704, 710.

AGED-752. Special Populations in Agricultural Education **Credit 3 (3-0)**

This advance course will focus on the diverse needs of students for learning to take place. Special emphasis will be placed on the instruction of agricultural education to populations of students within economic, gender, ethnic, cultural, political, physical differences. Students will discover and use educational theory to examine strategies and plans to overcome problems in their educational occupations. Students will research both legal requirements and expectations that effect what can be done with increase student learning. Students will be required to develop and present a diversity management plan for their program. Prerequisite(s): AGED 700, 703, 704, 753.

AGED-753. Teaching and Assessment for Agricultural Professionals **Credit 3 (3-0)**

This course focuses on concepts and methods relevant for both formal and informal education presentations, effects that methods may have on individuals involved in the learning experience and demonstrations of proficiency in use of various educational methodologies, technologies and concepts. Students will focus on human learning development, diversity issues, motivational strategies to plan, use and evaluate student learning. Students will research and present projects based on the course of study. Students will keep a reflective journal based on the infusion of learning methods used in their educational occupations. Prerequisite(s): AGED 701, 704, 709, 710.

AGED-754. History of Agricultural Education and Extension **Credit 3 (3-0)**

Historical development, social and philosophical foundations, and current status in relation to the total vocational education program. Special attention is given to agricultural education and extension as it developed in the United States.

AGED-796. Master's Non-thesis Project Seminar **Credit 1 (1-0)**

This seminar will focus on the needs of bringing agricultural education programs up to date with public requirements and the success of all students. Students will be required to do outside reading in current educational trends in agricultural education and critique them. Students will present two seminars in this course. One will focus on an issue in agricultural education and the second will be based on the student's Agricultural Education Program Management Plan. Prerequisite: AGED 797.

AGED-797. Agricultural Education Program Management Plan Project **Credit 4 (4-0)**

Students in the Non-thesis option will be required to put a management plan together for their educational occupational program. The plan will include research on the needs and expectations of the educational program and the evidence that either shows compliance or plans to meet the programs needs. Students will work with their committee to establish the requirement of the plan and evidence which will be required to meet the plans expectations. Students will present their plan in AGED 796. Prerequisite(s): AGED 700, 703 and 710.

AGED-798. Seminar in Agricultural Education **Credit 1 (1-0)**

This course is designed for students who are in their last semester of their Master's program. The course focuses on the needs and expectations of being a Master Teacher and a leader in agricultural education. Students will be expected to present their Master Teacher portfolio at the end of the course. Students will also present seminars based on topics related to the overall themes, competencies, standards of the Agricultural Education Master's Program. Prerequisite: Last semester of the Master's Program.

AGRI-799. MS Thesis Research **Credit 6 (6-0)**

Master of Science thesis research under the supervision of the thesis committee chairperson, leading to the completion of the Master's thesis. This course is only available to thesis option students.

Animal Sciences

David W. Libby, Interim Chairperson
101 B.C. Webb Hall
(336) 334-7547

The Department of Animal Sciences offers a graduate program in Animal Health Science that emphasizes the effects of environmental factors upon animal growth and development, reproduction, and disease resistance. Courses are designed to provide a solid foundation of fundamental biological and biochemical principles within the disciplines of breeding and genetics, biotechnology, food safety, microbiology, nutrition, pathology, physiology, and toxicology.

OBJECTIVES

To advance scholarship in Animal Sciences and related disciplines; to prepare and increase the number of professionals with graduate training for employment in animal sciences, animal agriculture, biomedical, biotechnology and related industries, and to prepare students to enter Ph.D. degree programs.

DEGREE OFFERED

Master of Science - Animal Health Science

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission to the program are an undergraduate degree from an accredited four year college or university with a minimum grade point average of 2.6 (on a 4.0 scale), and a basic preparation in animal and or laboratory animal sciences, biological, physical or agricultural sciences, or related areas. Applicants who do not meet the requirements will be considered on an individual basis. Applicants are encouraged to provide GRE scores, although these scores are not required for admission or graduation. A minimum of 30 credit hours and a GPA of 3.0 is required for graduation

PROGRAM ORGANIZATION

Core Courses. Core courses provide the student with an understanding of the relationships between the animal and its environment, within specific biological disciplines. Core courses constitute 13 credit hours. Each student in the program is required to take the core courses.

Course	Title	Credit (Lec.-Lab.)
ANSC 701	Environmental Topics in Animal Health	3 (3-0)
ANSC 702	Seminar in Animal Health	1 (1-0)
AGRI 799	MS Thesis Research	6 (6-0)
AGRI 604	Research Design and Analysis	3 (2-2)
<i>Elective Courses:</i>		
ANSC 604	Administrative and Regulatory Policies Governing Animal Use	2 (2-0)
ANSC 611	Principles of Animal Nutrition	3 (3-0)
ANSC 614	Animal Breeding	3 (3-0)
ANSC 624	Physiology of Reproduction	3 (3-0)
ANSC 637	Environmental Toxicology	3 (2-3)
ANSC 641	Disease Management of Livestock and Poultry	3 (3-0)
ANSC 665	Techniques in Biotechnology	3 (2-2)
ANSC 712	Nutrition and Disease	3 (3-0)
ANSC 713	Global Livestock Systems	3 (2-2)
ANSC 723	Animal Physiology	3 (3-0)
ANSC 708	Special Problems in Animal Health	2 (2-0)
ANSC 782	Cellular Pathobiology	3 (3-0)
ANSC 771	Bioinformatics and Design Analysis	3 (3-0)
LASC 653	Laboratory Animal Management and Clinical Techniques	4 (2-6)

LASC 660	Special Techniques in Specimen Preparation, Immunological Techniques, Electron Microscopy Radioisotopes, Radiology or Histotechnology	3 (1-6)
BIOL 671	Principles of Immunology	3 (3-0)
CHEM 651	General Biochemistry	3 (3-0)

COURSES WITH DESCRIPTION IN ANIMAL SCIENCES

For Advanced Undergraduate and Graduate Students

ANSC-604. Administrative and Regulatory Policies Governing Animal Use Credit 2 (2-0)

Regulations that impact the use of animals for research, education and testing. Federal, state and local regulations and policies. Regulations, facilities, and practices involving the use of hazardous agents (biological, chemical, and physical) which affect the safety of humans and animals. Prerequisite: Permission of instructor.

ANSC-611. Principles of Animal Nutrition Credit 3 (3-0)

Fundamentals of modern animal nutrition. Nutrient metabolism and role in productive functions. Prerequisite: ANSC 212 or permission of instructor.

ANSC-613. Livestock and Meat Evaluation Credit 2 (1-2)

Selection and evaluation of desirable animals in both market and breeding classes. Identification and evaluation of wholesale and retail cuts of meat. Prerequisites: ANSC 312 and ANSC 413.

ANSC-614. Animal Breeding Credit 3 (3-0)

Application of genetic and breeding principles to livestock production and improvement. Phenotypic and genotypic effects of selection methods; mating systems. Prerequisites: ANSC 211 and ANSC 214.

ANSC-615. Selection of Meat and Meat Products Credit 3 (2-2)

Identification, grading and cutting of meats. Prerequisites: ANSC 421 or ANSC 416.

ANSC-619. Special Problems in Livestock Management Credit 3 (3-0)

In depth study of problems in feeding, breeding, and management in the production of beef cattle, sheep and swine. Prerequisite: Senior standing.

ANSC-624. Physiology of Reproduction in Vertebrate Species Credit 3 (3-0)

Mechanisms of reproductive processes with special emphasis on their interaction with the disciplines of nutrition, immunology and biochemistry. Prerequisites: LASC 461 or ANSC 723 or permission of instructor.

ANSC-637. Environmental Toxicology Credit 3 (2-3)

Sources, distribution, and toxicity of chemicals which are hazardous to the environments of man and animals. Prerequisite: LASC 636 or permission of instructor.

ANSC-641. Disease Management of Livestock and Poultry Credit 3 (3-0)

Prevention and control of diseases in livestock species and poultry; Micro- and macroenvironments that result in disease. Prerequisites: ANSC 451 or permission of instructor.

ANSC-657. Poultry Anatomy and Physiology Credit 3 (2-2)

Structure and function of tissues, organs, and systems of the domestic fowl. Prerequisite: ANSC 451.

ANSC-659. Special Problems in Poultry Credit 3 (3-0)

Assignment of work in a student's area of interest; project method in Poultry Science. Prerequisite: Three advanced courses in Poultry Science.

ANSC-665. Techniques in Biotechnology Credit 3 (2-2)

Basic principles and laboratory experiences in biotechnology. Concepts of DNA structure, function, related applications in biotechnology. Isolating DNA and RNA; genomic DNA and

plasmid DNA analysis, gel electrophoresis, Southern hybridizations, gene probes.
Prerequisites: ANSC 214, CHEM 251, BIOL 466 or permission of instructor.

LASC-653. Laboratory Animal Management and Clinical Techniques **Credit 4 (2-6)**
Principles, theories and current concepts of Laboratory Animal Science. Government regulations, ethical consideration, animal facility management and animal health surveillance.
Prerequisite: Permission of instructor.

LASC-660. Special Techniques in Specimen Preparation, Immunological Techniques, Electron Microscopy, Radioisotopes, Radiology or Histotechnology **Credit 3 (1-6)**
Special expertise in either preparation of animal models for classroom, museum and special display, the theoretical and practical aspects of immunological techniques, electron and light microscopy, radiology, tissue culture or histochemistry. Prerequisite: Permission of instructor.

BIOL-671. Principles of Immunology **Credit 3 (3-0)**
A study of mammalian immune responses; particularly in humans. Special emphasis will be placed on the physiology, genetics, and regulation of immune responses. Interrelationships between nonspecific and specific immune reactions, humoral and cell-mediated immunity, effector cells, and diseases are also stressed; along with research and diagnostic methodologies.
Prerequisites: BIOL 221 and BIOL 466; CHEM 221 and CHEM 222.

CHEM-651. General Biochemistry **Credit 3 (3-0)**
A study of modern biochemistry. This course emphasizes chemical kinetics and energetics associated with biological reactions and includes a study of carbohydrates, lipids, proteins, vitamins, nucleic acids, hormones, photosynthesis, and respiration. Prerequisites: CHEM 431 and CHEM 442.

GRADUATE STUDENTS ONLY

ANSC-701. Environmental Topics in Animal Health **Credit 3 (3-0)**
Influence of the environment upon the health status of animals within the disciplines of epidemiology, toxicology, pathobiology, reproductive physiology, nutrition, and microbiology.

ANSC-702. Seminar in Animal Health **Credit 1 (1-0)**
Seminar includes faculty, graduate students, and guest lectures on research, scientific methods, the publication process and related topics in the field of animal health sciences.

ANSC-708. Special Problems in Animal Health **Credit 2 (2-0)**
Independent investigations to strengthen the student's knowledge of the scientific methods. Investigations are conducted within a variety of research areas congruent with the environmental focus of the Animal Health Science program.

ANSC-712. Nutrition and Disease **Credit 3 (3-0)**
The effect of altering the levels and ratios of nutrients upon the health of an animal and resultant biochemical or biological processes. The effects of disease upon altered nutrient supply.
Prerequisite: ANSC 611 or permission of instructor.

ANSC-713. Global Livestock Systems **Credit 3 (2-2)**
Theoretical constructs of livestock systems in different agro-ecological zones and farming systems in the US and the world. Discussion of literature and research techniques related to animal production in various systems. Economic contributions, environmental, and socio-political impact of domestic animals.

ANSC-723. Animal Physiology **Credit 3 (3-0)**
An in-depth study of function and interrelationships among nervous, muscular, circulatory, respiratory, digestive, urinary and reproductive systems of laboratory and farm animals.
Prerequisite: Permission of instructor.

ANSC-771. Bioinformatics and Genome Analysis **Credit 3 (3-0)**
The course will be on bioinformatics and its application to genome analysis, computational tools and methods for organizing data, as well as large scale DNA sequencing, gene expression analysis methods and algorithms for basic and advanced search techniques.

ANSC-782. Cellular Pathobiology

Credit 3 (3-0)

Current concepts of the structure, function and pathobiology of the cell. Methodologies used to study the cell and its processes. Prerequisite: CHEM 651 or permission of instructor.

**AGRI 799. Thesis Research in Agriculture and
Environmental Science**

Credit 1-6 (1-0) to 6 (6-0)

AGRI-999. Continuation of Thesis

Credit 1 (1-0)

Biology

Goldie S. Byrd, Chairperson
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OBJECTIVES

The Department's primary objective for the Master of Science degree program is to prepare students to enter and complete doctoral programs in order to become productive teachers and researchers. To support that objective, this program will develop in all participants, through research experiences, and other enrichment activities, independent thinking, creativity, critical judgment and personal integrity. Specifically, this program is designed to enhance the students' ability to design experiments, to analyze results, to become competent using state-of-the-art research equipment, enhance manipulative skills, and to improve the students' proficiency in oral and written communication. An additional critical objective is to enable students to score at or above the 50th percentile on the GRE Subject Test in Biology after their first year in residency.

The Department's primary objective for the Master of Science, Secondary Education degree program is to enhance the ability of teaching professionals to convey the fundamental concepts of biology at the secondary level. Additionally, this program will develop, through experiential learning, instruction, and other creative activities, independent thinking, critical judgment and personal integrity, particularly as they relate to the learning process. The department will provide an environment for teaching professionals to undertake advanced studies from the array of biological disciplines and expand their understanding of and appreciation for the world of living things.

DEGREES OFFERED

Master of Science in Biology (Thesis Option)
(30 semester hours including 6 hours of thesis research. Fifty percent of the accumulated hours **must** be at or above the 700 level.)

Master of Science in Biology (Non-Thesis Option)
(30 semester hours, including master's project. Fifty percent of the accumulated hours **must** be at or above the 700 level.)

Master of Science in Biology, Secondary Education
(39 semester hours of which 24 are to be in Biology and 15 are to be in Education. Fifty percent of the accumulated hours **must** be at or above the 700 level. There are two options in this degree program: thesis and non-thesis.)

GENERAL ADMISSION REQUIREMENTS

The admission of students to both graduate degree programs is consistent with the general admission requirements of the School of Graduate Studies. Specific Departmental requirements are chosen to assure the success of students admitted to its graduate programs. A student wishing to be accepted as a candidate to either program must have completed, on the undergraduate level, chemistry through Organic II, one year of calculus, one year of physics (calculus-based physics is preferred) and courses in cellular and molecular biology. Students lacking these requirements may be given provisional admission and be required to successfully complete some or all of these courses before being admitted to candidacy. All applicants must submit GRE scores (General and Subject Test in Biology) to the Graduate School. Applicants must submit a personal statement highlighting their academic accomplishments and stating their career goals. Applicants who submit transcripts from foreign institutions must provide credentials verified by a United States-based transcript verification service. In addition, the Master of Science in Biology, Secondary Education requires the following:

- (a) Have two years of supervised instructional experience in a private or public school setting, laboratory instruction while enrolled in a graduate program, or as a lecturer in a community college or four-year college or university.

- (b) Hold or obtain a North Carolina “A” Teaching Certificate at the elementary, middle, or secondary level or its equivalent license from another state.
- (c) Submit official scores for the Graduate Record Examination General Test or Miller Analogies Test.
- (d) Have an undergraduate overall GPA of 3.0 or better on a 4.0 scale.
- (e) Submit a satisfactory essay providing a statement on the applicant’s purpose for pursuing a master’s degree.

Application deadlines for fall and spring semester admissions are July 15th and November 15th, respectively. **The student is advised to read the Graduate Bulletin very carefully for additional graduate school requirements for admission to candidacy for a degree as well as other Departmental requirements.**

SPECIFIC PROGRAM REQUIREMENTS

MASTER OF SCIENCE IN BIOLOGY (THESIS OPTION)

1. BIOL 862, 863 (Thesis Research, 6 semester hours)
2. BIOL 701, 702 (Seminar, 2 semester hours)
3. CHEM 651, 652 (Biochemistry, 5 semester hours)
4. Complete a minimum of 17 additional semester hours bringing the total to 30 semester hours. Courses for graduate credit in Biology may be selected from Biology courses at the 600 – 800 levels. Please note that fifty percent must come from courses at or above the 700 level.
5. Maintain a 3.0 grade point average.
6. Attend all Departmental Seminars.
7. Satisfactorily complete an examination in a foreign language.
8. Have at least one academic year of residence at A&T.
9. BIOL 788 (Comprehensive Examination, 0 semester hours). This is the recording mechanism for students to meet the Comprehensive Examination requirement. The student must register for this “course” the semester he/she will take the Comprehensive Examination and the student must earn a *P* for pass. To sit for this examination the student must have a grade point average of 3.00 or greater and must have successfully completed all graduate course work (except course work currently in progress).
10. Satisfactorily present and defend the thesis.

MASTER OF SCIENCE IN BIOLOGY (NON-THESIS OPTION)

1. BIOL 712 (Master’s Project, 3 semester hours)
2. BIOL 701, 702 (Seminar, 2 semester hours)
3. CHEM 651, 652 (Biochemistry, 5 semester hours)
4. Complete a minimum of 23 additional semester hours bringing the total to 33 semester hours. Courses for graduate credit in Biology may be selected from Biology courses at the 600 – 800 levels. Please note that fifty percent must come from courses at or above the 700 level.
5. Maintain a 3.0 grade point average.
6. Attend all Departmental Seminars.
- 7.. Have at least one academic year of residence at A&T.
8. BIOL 788 (Comprehensive Examination, 0 semester hours). This is the recording mechanism for students to meet the Comprehensive Examination requirement. The student must register for this “course” the semester he/she will take the Comprehensive Examination and the student must earn a *P* for pass. To sit for this examination the student must have a grade point average of 3.00 or greater and must have successfully completed all graduate course work (except course work currently in progress).
9. Satisfactorily complete and defend a Master’s Project.

MASTER OF SCIENCE IN BIOLOGY, SECONDARY EDUCATION

The Master of Science in Biology, Secondary Education program has two options; both require 39 hours of graduate course work. The thesis option requires BIOL 862, which includes thesis research carried out under the supervision of a thesis advisor. The non-thesis option requires the preparation of a product of learning portfolio (lectures, laboratories, demonstrations, *etc.*) developed from the area courses in biology and consistent with the State Department of Public Instruction’s mandated curriculum. The learning portfolio will be assembled under the supervision of a graduate advisor. Under both options the student must:

1. Complete the 5 courses of the 15 credit hour Professional Core (CUIN 619, CUIN 711, CUIN 721, CUIN 728, and CUIN 729).

2. Complete 8 or more biology courses (24 semester hours) that are approved by the graduate advisor.
3. Maintain a 3.0 grade point average
4. Have at least one academic year of residence at A&T.
5. Pass final comprehensive examinations in Biology and Education. BIOL 788 (Comprehensive Examination, 0 semester hours) is the recording mechanism for students to meet the Comprehensive Examination requirement in Biology. The student must register for this "course" the semester he/she will take the Comprehensive Examination and the student must earn a *P* for pass. To sit for this examination the student must have a grade point average of 3.00 or greater and must have successfully completed all graduate course work (except course work currently in progress).
6. In the thesis option, satisfactorily present and defend the thesis.

LIST OF GRADUATE COURSES

Course	Title	Credits (lec-lab)
BIOL 610	Prokaryotic Biology	4 (2-4)
BIOL 620	Food Microbiology	4 (2-4)
BIOL 621	Soil Microbiology	4 (2-4)
BIOL 630	Molecular Genetics	3 (3-0)
BIOL 631	Endocrine Physiology	3 (3-0)
BIOL 640	Introduction to Bioinformatics and Genomic Research	3 (1-4)
BIOL 642	Special Problems in Biology	3 (2-2)
BIOL 650	Frontiers in Molecular Biology	4 (2-4)
BIOL 665	Evolution	3 (3-0)
BIOL 667	Animal Physiology	3 (3-0)
BIOL 671	Principles of Immunology	3 (3-0)
BIOL 700	Environmental Science	3 (3-0)
BIOL 701	Biological Seminar	1 (0-2)
BIOL 702	Biological Seminar	1 (0-2)
BIOL 703	Experimental Methods in Biology	4 (2-4)
BIOL 704	Cell and Molecular Biology	3 (3-0)
BIOL 712	Master's Project	3 (0-6)
BIOL 739	Radio-isotope Techniques and Radiotracer Methods	4 (2-4)
BIOL 740	Essentials of Plant Anatomy	3 (2-2)
BIOL 741	Applied Plant Ecology	3 (2-2)
BIOL 742	Physiology of Vascular Plants	3 (2-2)
BIOL 743	Developmental Plant Morphology	3 (2-2)
BIOL 744	Plant Nutrition	3 (2-2)
BIOL 749	Recent Advances in Cell Biology	3 (3-0)
BIOL 750	Microscopy Technique	3 (1-4)
BIOL 759	Experimental Developmental Biology	3 (1-4)
BIOL 765	Introductory Experimental Zoology	3 (2-2)
BIOL 780	Animal Physiological Ecology	3 (3-0)
BIOL 788	Comprehensive Examination	0 (0-0)
BIOL 862	Biology Thesis I	3 (0-6)
BIOL 863	Biology Thesis II	3 (0-6)

COURSE DESCRIPTIONS IN BIOLOGY

Advanced Undergraduate and Graduate Courses

BIOL-610. Prokaryotic Biology

Credit 4 (2-4)

A survey of the taxonomy, classification, ultrastructure, reproduction, physiology, and ecology of selected bacteria and bacteriophages. The laboratory will emphasize self-instruction and independent study. Prerequisites: Biology 200 or 221; Biology 466.

BIOL-620. Food Microbiology

Credit 4 (2-4)

A survey of selected topics in food microbiology. Approximately one-third of the course will cover the metabolic pathways, organisms and processes involved with food production from fermented dairy products, vegetables, fruits and meats. Food spoilage, preservation, infection, and intoxication will also be discussed. The laboratory will introduce students to the microorganisms involved with food production and spoilage. Prerequisites: Biology 200 or 221.

BIOL-621. Soil Microbiology **Credit 4 (2-4)**

An introduction to the role of soil microorganisms in soil fertility. The activity of nitrogen-fixing bacteria and those involved in the decomposition of organic waste materials will be emphasized. The laboratory will introduce students to the enumeration, distribution, and characterization of microorganisms important to soil microbiology. Prerequisites: Biology 200 or 221.

BIOL-630. Molecular Genetics **Credit 3 (3-0)**

DNA and RNA structure, function and processing in prokaryotic and eukaryotic systems. Various aspects of recombinant DNA technology will be examined. Prerequisites: Biology 201 and 466.

BIOL-631. Endocrine Physiology **Credit 3 (3-0)**

This course would provide a basic introduction to endocrine function and include recent advances in the field of endocrinology. Emphasis will be placed on general aspects of endocrine physiology, the organization of the endocrine system, mechanisms of hormone action, and control of endocrine secretion. Prerequisites: Biology 201 and 462.

BIOL-640. Introduction to Bioinformatics and Genomic Research **Credit 3 (1-4)**

The purpose of this course is to provide integrative experiences in computer and bench research in bioinformatics and genome science. Students will acquire hands-on experiences with web-based software and the tools research scientists are using to study the genomes of plants, microbes, humans and other organisms. They will input experimental data into one or more of these databases to perform genetic analyses for making predictions about gene identity, structure, function, similarities and phylogenetic relationships. They will also use the databases to develop biochips, probes and primers for various laboratory applications. The integrative benchwork will involve testing results from database queries in the laboratory. This course will merge education and research and where possible engage students in investigative activities that involve collaborations with scientists on and off the campus. Prerequisites: BIOL 401 and BIOL 466. (F,S)

BIOL-642. Special Problems in Biology **Credit 3 (2-2)**

Research projects on specific problems in biology for advanced students. Prerequisites: Biology 462 or 466 and permission of instructor. Prerequisites: Biology 462 or 466 and permission of instructor.

BIOL-650. Frontiers in Molecular Biology **Credit 4 (2-4)**

This course focuses on the theory, methods and applications of recombinant DNA technology. It includes special topics in molecular, cellular and developmental biology. The laboratory will provide hands-on exposure to the polymerase chain reaction, gene sequencing, development of gene libraries and other techniques in molecular biology.

BIOL-661. Mammalian Biology **Credit 3 (3-0)**

A study of the evolutionary history, classification, adaptation and variation of representative mammals. Prerequisites: Biology 160 and 260.

BIOL-665. Evolution **Credit 3 (3-0)**

This course will emphasize the genetics of populations and sources of genetic variation; causes of genetic change in populations including natural selection; speciation; and the evolutionary history of life on earth. Prerequisites: Biology 310 and 466.

BIOL-667. Animal Physiology **Credit 3 (3-0)**

This course will provide students with an understanding of the current state of animal physiology at the level of the whole organism and its component organs and organ systems. Emphasis will be placed on function as it relates to survival of organisms in natural environments and on the regulation of homeostatic mechanisms. Topics would include metabolism, temperature regulation, reproductive mechanisms, circulation, gaseous exchange, nutrient processing, osmoregulation and ionic balance. Prerequisites: Biology 160 and 462.

BIOL-671. Principles of Immunology **Credit 3 (3-0)**

A study of mammalian immune responses; particularly in humans. Special emphasis will be placed on the physiology, genetics, and regulation of immune responses. Interrelationships between nonspecific and specific immune reactions, humoral and cell-mediated immunity, effector cells, and diseases are also stressed; along with research and diagnostic methodologies.

Prerequisites: Biology 221 and 466; Chemistry 221 and 222.

Graduate Students Only

BIOL-700. Environmental Biology **Credit 3 (3-0)**

The scientific study of man's living and non-living environment. The course emphasizes how our technologies and cultures impact the earth's ability to sustain both human civilization and the earth's biodiversity. Prerequisites: None.

BIOL-701. Biological Seminar **Credit 1 (0-2)**

Faculty will present lectures on their research areas to acquaint students with research opportunities in the department. Prerequisites: None.

BIOL-702. Biological Seminar **Credit 1 (0-2)**

Oral and written presentations by students on special topics and recent advances in the field of Biology. Strategies for writing a thesis will be discussed, and the preparation by students of a short proposal for thesis research will be encouraged. Prerequisites: None.

BIOL-703. Experimental Methods in Biology **Credit 4 (2-4)**

An introduction to the scientific method, basic techniques, and equipment used in experimental research in Biology. The course will provide a foundation for enabling students to initiate and conduct independent research. Prerequisites: None.

BIOL-704. Cell and Molecular Biology **Credit 3 (3-0)**

A course that integrates the most recent advances in molecular biology of structure and function in cells. Prerequisite: Biology 462.

BIOL-712. Master's Project **Credit 3 (0-6)**

In this course the student will conduct a research project under the supervision of an advisor. A written proposal, a final report, and an oral presentation and defense of the project before the project committee are required.

BIOL-739. Radio-isotope Techniques and Radiotracer Methods **Credit 4 (2-4)**

The techniques employed in the handling and measurement of radio-isotopes and their use as tracer agents in biological investigations.

BIOL-740. Essentials of Plant Anatomy **Credit 3 (2-2)**

A study of the growth, development and organization of roots, stems, leaves, and reproductive organs of higher plants. Lectures, discussions, field trips, and the laboratories are employed in the presentation of this course.

BIOL-741. Applied Plant Ecology **Credit 3 (2-2)**

A study of the relations of plants to their environment with emphasis on climate and soil factors influencing their structure, behavior and distribution. Prerequisite: Biology 640, 740, or equivalent.

BIOL-742. Physiology of Vascular Plants **Credit 3 (2-2)**

Selected topics on the physiology of higher plants. Relationships of light quality, intensity, and periodicity to plant growth and reproduction: photosynthesis and photoperiodism. Chemical control of growth and reproduction, and the general aspect of plant metabolism. Lectures, conferences, laboratory work and field studies of higher plant ecology.

BIOL-743. Developmental Plant Morphology **Credit 3 (2-2)**

Growth and differentiation from a cellular viewpoint with emphasis on quantitative description and experimental study of development phenomena.

BIOL-744. Plant Nutrition **Credit 3 (2-2)**

A study of the subcellular organization of plants, inorganic and organic metabolism and respiration.

BIOL-749. Recent Advances in Cell Biology**Credit 3 (3-0)**

A course designed to present recent trends concerning functions of organized cellular and subcellular systems. Current research as it relates to the molecular and fine structure basis of cell function, replication, and differentiation will be discussed.

BIOL-750. Microscopy Technique**Credit 3 (1-4)**

This course is designed to develop the skills required to prepare cells, tissue, and organs for microscopic observation and study. Lectures will emphasize central concepts in microscopy. Prerequisites: Biology 201 and 462. Biology 465 is recommended.

BIOL-759. Experimental Developmental Biology**Credit 3 (1-4)**

This course is designed to provide students with a better understanding and appreciation of experimentation and experimental results in the area of developmental biology. Laboratory projects are experimental studies aimed at encouraging the reading and understanding of research papers in the literature. Prerequisite: Biology 561 or graduate standing.

BIOL-765. Introductory Experimental Zoology**Credit 3 (2-2)**

Studies of fertilization, breeding habits, regeneration, growth and differentiation of certain invertebrates and vertebrates from the experimental approach. Emphasis will be placed on laboratory procedures on the frog and the chick.

BIOL-780. Animal Physiological Ecology**Credit 3 (3-0)**

An introduction to the physiological adaptations of individuals that enable them to make the internal adjustments necessary to grow and reproduce in changing environments. This course will emphasize the physiological strategies for nutrient acquisition, gaseous exchange, water and ion balance, and thermal tolerance. Prerequisites: Biology 310 and 462.

BIOL-788. Comprehensive Examination**Credit 0 (0-0)**

This course is the recording mechanism for students to meet the Comprehensive Examination requirement. The student must register for this "course" the semester he/she will take the Comprehensive Examination and the student must earn a *P* for pass.

BIOL-862. Biology Thesis I**Credit 3 (0-6)**

Master's level research in biology. Prerequisite: Consent of advisor.

BIOL-863. Biology Thesis II**Credit 3 (0-6)**

Master's level research in biology. Prerequisites: Biology 862 and consent of advisor.

Chemical and Mechanical Engineering

Leonard Uitenham, Department Chairperson
Chemical Engineering - Master of Science
Mechanical Engineering - Master of Science
Mechanical Engineering – Doctor of Philosophy
<http://www.ncat.edu/~meen/>

GENERAL PROGRAM REQUIREMENTS

Each program in the Department is individually accredited and program requirements are defined by the individual programs.

OBJECTIVE

The objective of the graduate program in Chemical Engineering is to provide advanced level study in chemical engineering. The program will serve as preparation for further advanced study at the doctoral level or for advanced chemical engineering practice in industry.

DEGREE OFFERED

Master of Science in Chemical Engineering (MSChE)

GENERAL AND DEPARTMENTAL ADMISSION REQUIREMENTS

All applicants to MSChE program must have earned a bachelor's degree from a four-year college. Students that meet this requirement may be admitted to the graduate school.

Applicants are admitted without discrimination of race, color, creed, sex, religion or national origin. Applicants may be admitted to graduate studies unconditionally, provisionally, or as special students. Unconditional admission to the Master of Science in Chemical Engineering will be granted to graduates of ABET accredited chemical engineering programs that have attained a minimum of a 3.0 Grade Point Average on their overall undergraduate program of study. Provisional admission may be granted to persons with other qualifications. Applicants for provisional admission will be evaluated on a case-by-case basis.

A student admitted provisionally is required to meet with the CHEN Director to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate transcript. All provisionally admitted students must earn a minimum of a 3.0 grade point average on the first nine graduate course credits they complete. In addition, a "B" grade point average must be earned on all non-credit undergraduate courses, if any, required as a condition of admission. In addition to these provisions, other conditions may be imposed on a case-by-case basis as approved by the Graduate School.

The Master of Science in Chemical Engineering program consists of three distinct options: a thesis option, a project option and a course work option. Requirements for each of the options are given below:

Option	Semester Hours Required
Thesis	24 Credits of Courses and 6 Credits of Thesis
Project	30 Credits of Courses and 3 Credits of MS Project
Course Work	33 Credits of Courses

All students pursuing any of the MSChE options must complete four (4) courses from the MSChE core courses. In addition, students must enroll in the MSChE seminar each semester. Seminar credits do not count toward graduation requirements. The four (4) core courses must be selected from the following list:

Number	Course	Credit
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)
CHEN 630	Transport Phenomena I	3 (3-0)
CHEN 710	Transport Phenomena II	3 (3-0)

CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)

Thesis Option: All students enrolled in this program must take six (6) credit hours of thesis and twenty-four (24) credit hours of courses. Of the twenty-four (24) credit hours of courses, at least nine credit hours of courses must be at the 700 level and at least four courses (12 credit hours) from the MSChE core courses list. With the approval of the thesis advisor, a student may take nine (9) credit hours of graduate courses from outside the CHEN Department in the areas of Mathematics, Science and Engineering. Thesis option students must pass an oral, public defense of their work. The defense is evaluated by a committee of at least three faculty who are appointed by the thesis advisor and the CHEN Director. The defense committee serves as a professional review of the quality of the student's work and, in conjunction with the academic advisor, assists the student in the research work required for the thesis. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

Project Option: This option requires 30 credits of course work and 3 credits of project work (CHEN 796). The advisor and student select a suitable project of mutual interest to both. No formal advisory committee is required for the option. The project option may interest those who wish to investigate a specific problem and write a technical report. Of the thirty credit hours of courses, at least twelve credit hours of courses must be at 700 level. Students must take four courses (12 credit hours) from the MSChE core courses. With the approval of the MSChE Director and/or project advisor, a student may take nine credit hours of graduate courses from outside the CHEN Department. In lieu of a final comprehensive examination, project option students must pass a public, oral defense of their project. The defense is evaluated by a committee of at least three faculty who are appointed by the project advisor and the CHEN Director. One of the committee members will be the student's advisor. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

Course Work Option: This option requires 33 credits of course work approved by the advisor and MSChE Director. Of the thirty-three credit hours of courses, at least fifteen credit hours of courses must be at 700 level and at least four courses (12 credit hours) must be from the MSChE core courses. With the approval of the MSChE Director, a student may take nine credit hours of graduate courses from outside the CHEN Department. No formal advisory committee is needed, but the student must select an advisor. Students wishing to receive advanced training without an interest in solving a publishable problem or in writing a technical report will be attracted to this option. Students in this option may be asked to pass a written comprehensive examination. The examination follows the general course material of the student and is written by three or more examiners selected by the CHEN Director; one shall be the advisor. The student must satisfy the majority of examiners to pass the comprehensive examination. The examination is given during the student's final semester.

Advanced Undergraduate/Graduate Courses

Course	Title	Credits (Lec-Lab)
CHEN 600	Advanced Process Control	3 (3-0)
CHEN 605	Biochemical Engineering	3 (3-0)
CHEN 608	Bioseparations	3 (3-0)
CHEN 615	Fuels and Petrochemicals	3 (3-0)
CHEN 618	Air Pollution Control	3 (3-0)
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)
CHEN 622	Pollution Prevention	3 (3-0)
CHEN 625	Basic Food Process Engineering	3 (3-0)
CHEN 630	Transport Phenomena	3 (3-0)
CHEN 635	Mixing Processes and Equipment Scale-up	3 (3-0)
CHEN 640	Computer Aided Process Design	3 (3-0)
CHEN 645	Environmental Remediation	3 (3-0)
CHEN 655	Nanostructured Materials and Engineering Applications	3 (3-0)
CHEN 660	Selected Topics in Chemical Engineering Var.	Var. 1-3
CHEN 665	Introduction to Polymer Science and Engineering	3 (3-0)

CHEN 666	Special Projects in Chemical Engineering	Var. 1-3
CHEN 670	Solids Processing and Particle Technology	3 (3-0)
MCEN 610	Biological Applications of Engineering	3 (3-0)

Graduate Only Courses

CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 730	Advanced Biochemical Engineering	3 (3-0)
CHEN 740	Advanced Chemical Process Design	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)
CHEN 786	Special Chemical Engineering Project	3 (3-0)
CHEN 789	Special Topics	3 (3-0)
CHEN 792	Chemical Engineering Master's Seminar	1 (1-0)
CHEN 793	Master's Supervised Teaching	3 (3-0)
CHEN 794	Master's Supervised Research	3 (3-0)
CHEN 796	Master's Project	3 (3-0)
CHEN 797	Master's Thesis	3 (3-0)

CHEMICAL ENGINEERING COURSES AND DESCRIPTIONS CHEMICAL ENGINEERING GRADUATE/ ADVANCED UNDERGRADUATE COURSES

CHEN-600. Advanced Process Control **Credit 3 (3-0)**

The course covers advanced methods for controlling chemical processes: adaptive control, feed forward control, cascade control, multivariable control, multi-loop control, decoupling, and dead time compensation. Emphasis is placed on computer design. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-605. Biochemical Engineering **Credit 3 (3-0)**

The course covers basic phenomena involved in biological systems, biochemical reaction systems, microbiology, and biological processes. Application of engineering methods to the design and control of biological systems. Biochemical production of industrial chemicals. Biological waste treatment. Immobilized enzyme technology. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-608. Bioseparations **Credit 3 (3-0)**

The course is an introduction to the separation and purification of biochemicals. Separation processes are characterized as primarily removal of insolubles, isolation of products, purification or polishing. Processes covered include filtration, centrifugation, cell disruption, extraction, absorption, elution chromatography, precipitation, ultrafiltration, electrophoresis and crystallization. Students are required to complete a design project on a bioseparation process. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-615. Fuels and Petrochemicals **Credit 3 (3-0)**

Topics important to the production of fuels are covered. Topics include extraction and processing of fossil fuels, syngases, and fuels from renewable resources. Topics also include distillation, refining, fermentation, catalytic reactions, and removal of undesirable by-products. The design of fuel processes include emphasis on economic and environmental impact. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-618. Air Pollution Control **Credit 3 (3-0)**

The economic, social and health implications of air pollution and its control are covered. To understand the problems better, the sources, types and characteristics of man-made air pollutants will be discussed. The course will review some of the main regulations and engineering alternatives for achieving different levels of control. An air pollution control system will be designed. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Course is to be cross-referenced with CIEN 618) (DEMAND)

CHEN-620. Advanced Chemical Engineering Analysis **Credit 3 (3-0)**

Solution of chemical engineering problems by advanced mathematical techniques. Solution of uncoupled and coupled momentum, heat and mass transfer problems. Solution of linearized dynamic equations representing staged operations by matrix analysis. Advanced design and optimization of chemical processes. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-622. Pollution Prevention

Credit 3 (3-0)

The concept of pollution prevention and its application through industrial ecology, risk assessment and life-cycle assessment methodologies are covered. Topics include pollution prevention at the macroscale (industrial sector), mesoscale (unit operations), and microscale (molecular interactions). A process involving membrane separation steps will be designed and analyzed. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-625. Basic Food Process Engineering

Credit 3 (3-0)

This course covers basic food processing topics including food preparation operations. Topics included are slurry flow, processing operations, microbiology and health hazards, diseases and medicines, and their effects on humans. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-630. Transport Phenomena

Credit 3 (3-0)

Unified approach to momentum, energy, and mass transfer with emphasis on the microscopic approach. Development of the differential transport balances. Applications in solving simple chemical process problems. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-635. Mixing Processes and Equipment Scale-up

Credit 3 (3-0)

The courses cover practical design concepts of mixing and multi-phase processing in agitated tanks. Strategies for increasing plant throughput, improving contacting and mixing and selecting equipment will be given. This course provides information on: 1) judging the level of difficulty of a mixing process; 2) using practical elements of laminar, transitional and turbulent mixing; 3) mixing times and 4) increasing throughput for all types of systems and power. The course treats jet mixing, gas sparged mixing and mechanical mixing. The course provides basic concepts on using pilot plant studies for process translation and scale-up. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Spring)

CHEN-640. Computer-Aided Chemical Process Design

Credit 3 (3-0)

The development and use of computer-aided models for process equipment design is stressed. Model results are compared with the ASPEN PLUS simulation package. Students study the Interrelationships between design and process variables using computer simulation. Optimization methods are applied to chemical process design. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-645. Environmental Remediation

Credit 3 (3-0)

The course introduces students to traditional and developmental methods for removal and detoxification of hazardous wastes at contaminated sites and from industrial waste streams. Chemical, thermal, biological and physical methods of remediation are covered. The course deals with hazardous wastes in soils, groundwater, surface water, wastewater ponds and tanks. The emphasis is on destruction, removal and containment methods using mathematical models for contaminate fate and transport. Recent advances in emerging technologies are also discussed. Each student will complete an environmental remediation design project. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-655. Nanostructured Materials and Engineering

Credit 3 (3-0)

This course reviews and analyzes modern chemical engineering material processing technologies. Chemical vapor deposition, crystallization, electrochemical deposition, electroplating and supercritical fluid-based processing techniques for the production of nanostructured materials are discussed. This course also covers the effects of parameters (such as lattice structure, material composition, nucleation, crystal growth phenomena, chemical bonding, etc.) on the catalytic, electronic, optical and physical properties of metallic and ceramic materials. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-660. Selected Topics in Chemical Engineering **Credit 3 (3-0)**
Topics covered include selected chemical engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-665. Introduction to Polymer Science & Engineering **Credit 3 (3-0)**
This course is an introduction to the fundamentals of polymer science and engineering. Topics included are polymerization reaction mechanisms and kinetics, molecular weight distribution and measurement methods, crystallinity, morphology and phase transitions, structure-property relationships, solution properties and melt rheology. Commonly used polymer characterization techniques will be introduced. Industrial examples will be emphasized. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-666. Special Projects in Chemical Engineering **Credit 3 (3-0)**
Study arranged on a special chemical engineering topic of interest to both student and faculty member who will act as supervisor. Topics may be analytical and /or experimental and should encourage independent study. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall, Spring)

CHEN-670. Solids Processing and Particle Technology **Credit 3 (3-0)**
This course is an introduction to the fundamentals of solids processing and particle technology. Topics included are properties of particles, transport of particles, size reduction, size enlargement, filtration, centrifugation, clarification, drying of solids, crystallization, flotation, and safety hazards of fine powders. Industrial examples will be emphasized. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

MCEN-610. Biological Applications of Engineering **Credit 3 (3-0)**
This course covers the application of engineering principles and methods to problems in medicine, the integration of engineering with biology, and the emerging industrial opportunities. Examples from a variety of engineering disciplines will be provided. The ethical concerns associated with some emerging life science applications will be explored. Lab experiments will be utilized in the course to provide hands-on experience with life science concepts. Required is a research paper on an emerging application of life science in engineering. Prerequisite: Consent of instructor. (Spring)

CHEMICAL ENGINEERING GRADUATE ONLY COURSES

CHEN-710. Transport Phenomena II **Credit 3 (3-0)**
This course is an advanced treatment of the mechanisms of momentum, heat and mass transport. Emphasis is on methods of solution of transport problems for coupled systems where two or more transport processes interact. Other topics include Non-Newtonian Flow, Boundary Layer Theory, and the Analysis and solution of transport problems of significance in chemical processes. (DEMAND)

CHEN-720. Advanced Chemical Reaction Engineering **Credit 3 (3-0)**
This course includes an advanced treatment of chemical reaction engineering including the effect of non-ideal flow and fluid mixing on reactor design, as well as multi-phase reaction system and heterogeneous catalysis and catalytic kinetics. (Fall)

CHEN-730. Advanced Biochemical Engineering **Credit 3 (3-0)**
This course is the study of advanced topics in biochemical engineering and enzyme engineering, highlighting research trends. Modeling and optimization of biochemical systems are also covered, as well as the design and analysis of enzyme reactors and the use of enzymes in industrial, environmental and medical applications. (DEMAND)

CHEN-740. Advanced Chemical Process Design **Credit 3 (3-0)**
Topics in advanced conceptual process engineering such as process analysis, process synthesis and process optimization are covered. Specific topics include: flowsheeting, design variable selection, computational algorithm formulation, separation sequences, heat exchanger networks,

recycle-purge processes, process design and simulation software development, including physical and thermodynamic properties packages. (DEMAND)

CHEN-750. Separation Processes

Credit 3 (3-0)

Differential and equilibrium stage operations involving non-isothermal and multi-component systems are covered. Other topics covered include simultaneous mass transfer and chemical reaction and dispersion effects. Applications to operations such as absorption, extraction, chromatography, distillation, ion exchange, and membrane separation are also studied. (Spring)

CHEN-760. Advanced Chemical Engineering Thermodynamics

Credit 3 (3-0)

This is an advanced course covering topics in molecular thermodynamics of fluid phase equilibria. Statistical thermodynamics and thermodynamics of nonequilibrium processes are introduced. (Spring)

CHEN-786. Special Chemical Engineering Project

Credit 3 (3-0)

The course is intended for students who want to complete an analytical or experimental project of interest to the student and instructor. The course may be completed by Project Option students, but does not substitute for Master's project. (Fall, Spring)

CHEN-789. Special Topics

Credit 3 (3-0)

A course designed to allow the introduction of potential new courses on a trial basis or the offering of special course topics on a once-only basis. The course may be offered to individuals or groups of students. A definite topic and the title must be agreed upon by the advisor before the student registers for the course. (DEMAND)

CHEN-792. Master's Seminar

Credit 1 (1-0)

This course provides a forum for the presentation and discussion of selected topics of interest to chemical engineers such as faculty research interests, communication, safety, job prospects and research results. (Fall, Spring)

CHEN-793. Master's Supervised Teaching

Credit 3 (3-0)

Students will gain teaching experience under the mentorship of a faculty member who assists the student in planning for the teaching assignment, observes and provides feedback to the student during the teaching assignment, and evaluates the student upon completion of the assignment. (DEMAND)

CHEN-794. Master's Supervised Research

Credit 3 (3-0)

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty. (DEMAND)

CHEN-796. MS Chemical Engineering Project

Credit 3 (3-0)

This is an independent, analytical or experimental project involving research or design in an area of interest to the instructor and the student. This course must be completed by, and only by, Master of Science in Chemical Engineering (MSChE) project option students. A written proposal must be submitted to outline the project. A written report and an oral defense are required. (Fall, Spring, Summer)

CHEN-797. Master's Thesis

Credit 3 (3-0)

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the master's thesis. The course is only available to thesis option students. (Fall, Spring, Summer)

Chemistry

Claude N. Lamb, Interim Chairperson
Room 116, Hines Hall
(336) 334-7601

OBJECTIVES

The objective of the Graduate Division in Chemistry is to provide the theoretical and experimental training experiences necessary for those students pursuing a Master of Science degree in Chemistry. The Department also offers special courses that may be used for teacher renewal certificates.

DEGREES OFFERED

Master of Science- Chemistry
Master of Science- Chemistry, Secondary Education
Computational Science and Engineering – Interdisciplinary Masters of Science
Energy and Environmental Studies – Interdisciplinary Ph.D.

GENERAL REQUIREMENTS

Admission to the Graduate School under one of the following options:

1. Unconditional admission
2. Provisional admission
3. Post-baccalaureate (PBS)

DEPARTMENTAL REQUIREMENTS

Admission to degree programs for the Master of Science in Chemistry and the Master of Science in Chemistry, Secondary Education require:

1. Baccalaureate degree from an accredited undergraduate institution

Admission to the Master of Science in Chemistry requires:

2. An undergraduate major in chemistry that includes one year of physical chemistry and one year of differential and integral calculus.

Admission to the Master of Science in Chemistry Education also requires the following:

1. Official scores of the GRE or MAT Test
2. NC Class A licensure in Education (secondary) or the equivalent from another state
3. A passing score on the indexed rating for admissions criteria
4. A satisfactory essay providing a statement of purpose for Master's degree study
5. Satisfactory recommendations from three professional educators

M.S. in Chemistry:- Thesis Option

Must complete the following:

1. *Required Courses*

Chemistry 711 — Structural Inorganic Chemistry

Chemistry 722 — Advanced Organic Chemistry

Chemistry 743 — Chemical Thermodynamics

Chemistry 701 — Seminar

Chemistry 732 — Advanced Analytical Chemistry

Chemistry 799 — Thesis Research

Chemistry 702 — Chemical Research

(A maximum of 9 hrs. may be earned in 702)

2. *Other Requirements*

a. 2-9 semester hours in electives

b. Satisfactory completion of an examination in foreign language or computer language

c. Pass comprehensive examinations in three of the five major areas of chemistry:

analytical, biochemistry, inorganic, organic and physical. The comprehensive

examination must be passed within two sittings for any areas being tested

d. Satisfactory presentation and defense of a thesis.

e. One academic year of residence at A&T

M. S. in Chemistry –Project Option

This option requires 30 hours of course work and 3 credits of project research (Chem.

703). The advisor and the student select a suitable project of mutual interest to both. A formal advisory committee is required for this option. The project advisor appoints the project committee members after consultation with the student. All project option students must write a final report on their project and defend their findings in a public seminar. The project report and project defense, are evaluated by a project committee composed of three faculty members, one of which is the project advisor. An affirmative vote by the majority of the project committee, after the project defense, is required for the student to pass. Of the 33 credit hours of course work required, at least 17 credits must be at the 700 levels. The recommended courses are as follows:

1. Required Courses (17 Credit hours) Credit

Chemistry 701 – Seminar 1.0
 Chemistry 711 – Structural Inorganic Chemistry 3.0
 Chemistry 722 – Advanced Organic Chemistry 3.0
 Chemistry 732 – Advanced Analytical Chemistry 3.0
 Chemistry 743 – Chemical Thermodynamics 3.0
 Chemistry 703 – Masters Project Research 3.0
 Chemistry 715, 725, 735, 745, or 755 1.0

2. Electives (16 Credit hours)

Students are required to complete a minimum of 11 Cr. Hrs. from the Chemistry electives and the other 5 Cr. Hrs. from Chemistry and/or non-chemistry electives listed below:

Chemistry electives Credit

Chemistry 610 Inorganic Synthesis 2.0
 Chemistry 611 Advanced Inorganic 3.0
 Chemistry 621 Intermediate Organic 3.0
 Chemistry 651 General Biochemistry 3.0
 Chemistry 652 General Biochemistry Lab 2.0.
 Chemistry 663* Selected Topics in Chem. Instruction I 1.0
 Chemistry 664* Selected Topics in Chem. Instruction II 1.0
 Any 700 level courses included in the Department's regular offerings.

*These courses are required for Graduate Teaching Assistants

Non-Chemistry electives

Any 600 or 700 level course from the School of Agriculture and Environmental Sciences or College of Engineering

3. Other requirements

- Satisfactory completion of an examination in foreign language or computer language
- Satisfactory presentation and defense of the project
- One academic year of residence at A&T
- Student must pass comprehensive examinations in three of the following five areas: analytical, biochemistry, inorganic, organic, and physical chemistry. The comprehensive examinations must be passed within two sitting for any areas being tested.

M.S. in Chemistry Education: Thirty nine (39) semester hours required.

The Master of Science in Chemistry Education program consists of a thesis option or a special project option. Both options require 15 semester hours of Professional Education, 17 semester hours of chemistry and 7 semester hours of chemistry electives. Elective courses may come from chemistry courses at the 600 and 700 levels. In addition the student must:

- Maintain a 3.0 grade point average
- Present a seminar to faculty and students of the Chemistry Department upon completion of the thesis or research project
- In the thesis option, satisfactorily present and defend the thesis

Professional Education Core Requirements (15 Credit hours)

Course	Title	Credit
CUIN 711	Research and Inquiry	3
CUIN 713	Learning Theories	3

CUIN 746	Technology	3
CUIN 712	Diversity	3
CUIN 721	Advanced Methods	3

Required Chemistry Courses (17 Credit hours)

Course	Title	Credit
CHEM 711	Structural Inorganic Chemistry	3
CHEM 722	Advanced Organic Chemistry	3
CHEM 732	Advanced Analytical Chemistry	3
CHEM 743	Chemical Thermodynamics	3
CHEM 702	Chemical Research	4
CHEM 701	Seminar	1

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

Course	Title	Credit
CHEM 610	Inorganic Synthesis	2
CHEM 611	Advanced Inorganic	3
CHEM 621	Intermediate Organic Chemistry	3
CHEM 624	Qualitative Organic Chemistry	3
CHEM 631	Electroanalytical Chemistry	3
CHEM 632	Environmental Chemistry	3
CHEM 641	Radiochemistry	3
CHEM 642	Radioisotope Techniques and Application	2
CHEM 643	Introduction to Quantum Mechanics	4
CHEM 651	General Biochemistry	3
CHEM 652	General Biochemistry Lab	2
CHEM 673	Introduction to Computational Chemistry	
CHEM 674	Computational Methods in Protein Modeling and Drug Design	

GRADUATE STUDENTS ONLY

(Inorganic)

Course	Title	Credit
CHEM 711	Structural Inorganic Chemistry	3
CHEM 716	Selected Topics in Inorganic Chemistry	3

(Organic)

CHEM 721	Elements of Organic Chemistry	3
CHEM 722	Advanced Organic Chemistry	3
CHEM 723	Organic Chemistry	2
CHEM 726	Selected Topics in Organic Chemistry	3
CHEM 727	Organic Preparations	1-2

(Biochemistry)

CHEM 756	Selected Topics in Biochemistry	3
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(Analytical Chemistry)

CHEM 731	Modern Analytical Chemistry	3
CHEM 732	Advanced Analytical Chemistry	3
CHEM 736	Selected Topics in Analytical Chemistry	3

(Physical Chemistry)

CHEM 741	Principles of Physical Chemistry I	3
CHEM 742	Principles of Physical Chemistry II	3
CHEM 743	Chemical Thermodynamics	3
CHEM 744	Chemical Spectroscopy	3
CHEM 746	Selected Topics in Physical Chemistry	3
CHEM 748	Colloid Chemistry	2
CHEM 749	Chemical Kinetics	2

RESEARCH AND SPECIAL TOPICS

CHEM 701	Seminar	1
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CHEM 702	Chemical Research	2-5
CHEM 715	Special Problems in Inorganic Chemistry	1
CHEM 725	Special Problems in Organic Chemistry	1
CHEM 735	Special Problems in Analytical Chemistry	1
CHEM 745	Special Problems in Physical Chemistry	1
CHEM 755	Special Problems in Biochemistry	1

CHEMICAL INSTRUCTION

CHEM 663	Selected Topics in Chemistry INSTRUCTION I	1
CHEM 664	Selected Topics in Chemistry INSTRUCTION II	1
CHEM 765	Special Problems in Chemistry INSTRUCTION I	3
CHEM 766	Special Problems in Chemistry INSTRUCTION II	3
CHEM 767	Special Problems in Chemistry INSTRUCTION III	3
CHEM 768	Special Problems in Chemistry INSTRUCTION IV	3

COURSES WITH DESCRIPTION IN CHEMISTRY

Advanced Undergraduate and Graduate

CHEM-610. Inorganic Synthesis **Credit 2 (1-3)**

Discussion of theoretical principles of synthesis and development of manipulative skills in the synthesis of inorganic substances. Prerequisites: One year of organic chemistry; one semester of quantitative analysis.

CHEM-611. Advanced Inorganic Chemistry **Credit 3 (3-0)**

A course in the theoretical approach to the systematization of inorganic chemistry. Prerequisite: Chemistry 442.

CHEM-621. Intermediate Organic Chemistry **Credit 3 (3-0)**

An in-depth examination of various organic mechanisms, reactions, structures, and kinetics. Prerequisite: Chemistry 222.

CHEM-624. Qualitative Organic Chemistry* **Credit 5 (3-6)**

A course in the systematic identification of organic compounds. Prerequisite: One year of Organic Chemistry.

CHEM-631. Electroanalytical Chemistry **Credit 3 (3-0)**

A study of the theory and practice of polarography, chronopotentiometry, potential sweep chronoamperometry and electrodeposition. The theory of diffusion and electrode kinetics will also be discussed along with the factors that influence rate processes, the double layer, absorption and catalytic reactions. Prerequisite: Chemistry 431 or equivalent.

CHEM-632. Environmental Chemistry **Credits 3(3-0)**

This course begins with an overview of environmental science and technology. The course covers the study of the sources, reactions, transport, effects, and fates of chemical species in water, soil, and air. Different types of water pollutants, inorganic and organic air pollutants and pollutants in the soil will be discussed in detail. Sources, chemistry, and treatment of hazardous wastes will also be addressed. Finally, some of the analytical methods used in the determination of water and air pollutants will be covered in this course. Prerequisites: CHEM 221, 231, and 431 or permission of the instructor.

CHEM-641. Radiochemistry **Credit 3 (3-0)**

A study of the fundamental concepts, processes, and applications of nuclear chemistry, including natural and artificial radioactivity, sources, and chemistry of the radioelements. Open to advanced majors and others with sufficient background in chemistry and physics. Prerequisite: Chemistry 442 or Physics 406.

CHEM-642. Radioisotope Techniques and Applications **Credit 2 (1-3)**

The techniques of measuring and handling radioisotopes and their use in chemistry, biology, and other fields. Open to majors and non-majors. Prerequisite: Chemistry 102 or 105 or 107.

CHEM-643. Introduction to Quantum Mechanics **Credit 4 (4-0)**

Non-relativistic wave mechanics and its application to simple systems of means of the operator formulation. Prerequisites: Chemistry 442 and Physics 222. Corequisite: Mathematics 300.

CHEM-651. General Biochemistry **Credit 3 (3-0)**

A study of modern biochemistry. The course emphasizes chemical kinetics and energetics associated with biological reactions and includes a study of carbohydrates, lipids, proteins, vitamins, nucleic acids, hormones, photosynthesis, and respiration. Prerequisites: Chemistry 431 and 442.

CHEM-652. General Biochemistry **Credit 3 (3-0)**

This is a companion laboratory to Chemistry 651. Experimentation will include isolation and characterization of biochemical substances as well as studies of physical properties. Students will be introduced to a variety of techniques including high performance liquid chromatography, electrophoresis, and centrifugation. Corequisite: Chemistry 651. Prerequisites: Chemistry 432 and 444.

CHEM-673. Introduction to Computational Chemistry **Credits 3(2-2)**

This course introduces students to the basic principles of classical and quantum mechanics and their application to solving chemical/biochemical problems. A hands-on approach will be taken with equal time being spent in the classroom and in the laboratory. Prerequisites: CHEM 107, PHYS 242, and MATH 231 or their equivalent.

CHEM-674. Computational Methods in Protein Modeling and Drug Design **Credits 3(2-2)**

This course introduces various computational chemistry methods involved in modeling macromolecular proteins and structure-based drug design. A hands-on approach will be taken with equal time being spent in class and the laboratory. The course includes homology modeling, ab initio threading methods to model proteins from sequence to three-dimensional structures, chemoinformatics and structure-based drug design methods such as QSAR and docking. Prerequisite: CHEM 673

** Students are required to purchase supplemental materials for this course.*

INORGANIC CHEMISTRY

Graduate Students Only

CHEM-711. Structural Inorganic Chemistry **Credit 3 (3-0)**

A study of the stereochemistry and electronic properties of inorganic substances. Emphasis will be placed upon applications of group theory and upon spectroscopic and physical methods.

CHEM-716. Selected Topics in Inorganic Chemistry **Credit 3 (3-0)**

A lecture course on advanced topics of Inorganic Chemistry. Prerequisite: Chemistry 611 or permission of the instructor.

ORGANIC CHEMISTRY

Graduate Students Only

CHEM-721. Elements of Organic Chemistry **Credit 3 (2-3)**

A systematic study of the classes of aliphatic and aromatic compounds and individual examples of each. Structure, nomenclature, synthesis, and characteristic reactions will be considered. Illustration of the familiarity of organic substances in everyday life will be included. In the laboratory, preparation and characterization reactions will be performed.

CHEM-722. Advanced Organic Chemistry **Credit 3 (3-0)**

Recent developments in the areas of structural theory, stereochemistry, molecular rearrangement and mechanism of reactions of selected classes of organic compounds. Prerequisite: One year of Organic Chemistry or Chemistry 721.

CHEM-723. Organic Chemistry **Credit 2 (2-0)**

An advanced treatment of organic reactions designed to give students a working knowledge of

the scope and limitations of the important synthetic methods of Organic Chemistry.
Prerequisite: Chemistry 722.

CHEM-726. Selected Topics in Organic Chemistry **Credit 3 (3-0)**

A lecture course on advanced topics in Organic Chemistry.

CHEM-727. Organic Preparations **Credit 1-2 (0-2 to 4)**

An advanced laboratory course. Emphasis is placed on the preparation and purification of more complex organic compounds. Prerequisite: One year of Organic Chemistry.

BIOCHEMISTRY

Graduate Students Only

CHEM-756. Selected Topics in Biochemistry **Credit 3 (3-0)**

A lecture course on advanced topics in Biochemistry.

ANALYTICAL CHEMISTRY

Graduate Students Only

CHEM-731. Modern Analytical Chemistry **Credit 3 (2-3)**

The theoretical bases of Analytical Chemistry are presented in detail. In the laboratory, these principles, together with a knowledge of chemical properties, are used to identify substances and estimate quantities in unknown samples.

CHEM-732. Advanced Analytical Chemistry **Credit 3 (3-0)**

A lecture course in which the theoretical bases of Analytical Chemistry and their application in analysis will be reviewed with greater depth than is possible in the customary undergraduate courses. Equilibrium processes, including proton and electron transfer reactions and matter-energy interactions, will be considered. Prerequisite: One year of Analytical Chemistry or Chemistry 731.

CHEM-736. Selected Topics in Analytical Chemistry **Credit 3 (3-0)**

A lecture course on advanced topics in Analytical Chemistry.

PHYSICAL CHEMISTRY

Graduate Students Only

CHEM-741. Principles of Physical Chemistry I **Credit 3 (3-0)**

A review of the fundamental principles of Physical Chemistry, including the derivation of the more important equations and their application to the solution of problems. Prerequisite: Mathematics 606 or 622.

CHEM-742. Principles of Physical Chemistry II **Credit 3 (3-0)**

A continuation of Chemistry 741. May be taken concurrently with Chemistry 741.

CHEM-743. Chemical Thermodynamics **Credit 3 (3-0)**

An advanced course in which the laws of thermodynamics will be considered in their application to chemical processes. Prerequisite: Chemistry 442 or 742.

CHEM-744. Chemical Spectroscopy **Credit 3 (2-3)**

An advanced course in which the principles and applications of spectroscopy will be considered. Prerequisite: Chemistry 442 or 742.

CHEM-746. Selected Topics in Physical Chemistry **Credit 3 (3-0)**

A lecture course on advanced topics in Physical Chemistry. Prerequisite: Chemistry 442 or 742.

CHEM-748. Colloid Chemistry **Credit 2 (2-0)**

A study of the types of colloidal systems and the fundamental principles governing their preparation and behavior. Prerequisite: Chemistry 442 or 742.

CHEM-749. Chemical Kinetics **Credit 4 (4-0)**

A study of the theory of rate processes; application to the study of reaction mechanisms.
Prerequisites: Mathematics 222 and Chemistry 442 or 742.

RESEARCH AND SPECIAL PROBLEMS

Graduate Students Only

CHEM-663. Selected Topics in Chemistry Instruction I **Credit 1 (1-0)**

A study of the curriculum and educational materials developed for use in the Thirteen College Curriculum Program in Physical Science.

CHEM-664. Selected Topics in Chemistry Instruction II **Credit 1 (1-0)**

A continuation of Chemistry 663

CHEM-701. Seminar **Credit 1 (1-0)**

Presentation and discussion of library or laboratory research problems.

CHEM-702. Chemical Research **Credit 2-5 (0.6 to 15)**

A course designed to permit qualified students to do original research in chemistry under the supervision of a senior staff member. May be taken for credit more than once.

CHEM-703. Masters Project Research **Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project and the deliverables, must be submitted for approval. This course is only available to project option students. Prerequisite: Graduate standing.

CHEM-715. Special Problems in Inorganic Chemistry **Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Inorganic Chemistry. May be taken for credit more than once.

CHEM-725. Special Problems in Organic Chemistry **Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Organic Chemistry. May be taken for credit more than once.

CHEM-735. Special Problems in Analytical Chemistry **Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Analytical Chemistry. May be taken for credit more than once.

CHEM-745. Special Problems in Physical Chemistry **Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Physical Chemistry. May be taken for credit more than once.

CHEM-755. Special Problems in Biochemistry **Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Biochemistry. May be taken for credit more than once.

CHEM-765. Special Problems in Chemistry Instruction I **Credit 3 (3-0)**

A course designed to introduce students to techniques of Chemistry instruction at the college level.

CHEM-766. Special Problems in Chemistry Instruction II **Credit 3 (3-0)**

A continuation of Chemistry 765.

CHEM-767. Special Problems in Chemistry Instruction III **Credit 3 (3-0)**

A continuation of Chemistry 766.

CHEM-768. Special Problems in Chemistry Instruction IV **Credit 3 (3-0)**

A continuation of Chemistry 767.

CHEM-799. Thesis Research I

Credit 3 (3-0)

A course designed for conducting thesis research under the supervision of the thesis committee chairperson leading to the completion of the master's thesis. This course is only available to thesis option students. Prerequisite: Permission of advisor.

CHEM-999. Thesis Research II

Credit 0 (0-0)

A continuation of Chemistry 799. A written thesis must be produced and an oral thesis defense is required.

Civil and Environmental Engineering

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The Master of Science program in Civil Engineering is administered by the Civil, Architectural, Agricultural and Environmental Engineering (CAAE) Department and is designed to accommodate graduates from Civil and Environmental Engineering, Architectural Engineering, and Bioenvironmental Engineering. The program also accepts qualified graduates from other closely related academic fields.

OBJECTIVE

The objective of the Civil Engineering graduate program is to provide educational opportunities to professionals in the Piedmont Triad for advanced study and research in the following areas: Environmental/Water Resources, Structures/Geotechnical, Transportation/Regional Development, and Energy Resources/ Systems.

One or more courses in each of the above areas are scheduled every semester and are offered when student demand meets the University's minimum enrollment requirement. Students may, therefore, be required to adjust their curriculum plan in response to the availability of courses.

DEGREE OFFERED

Master of Science - Civil Engineering

ADMISSION REQUIREMENTS

All applicants for graduate study must have earned a bachelor's degree from a four-year accredited college. Prospective students must follow all current procedures of the School of Graduate Studies.

The minimum requirement for unconditional admission to the Master of Science in Civil Engineering Program is an undergraduate degree from an ABET accredited Civil Engineering, Architectural Engineering, or Bioenvironmental Engineering program with a minimum of 3.0 (out of 4.0) Grade Point Average on the overall undergraduate program of study. The other two categories of admission, provisional and special student, may also be used on a case-by-case basis as described below.

Persons may be admitted provisionally to the MSCE program if any of the following conditions apply:

1. The undergraduate degree is not from an ABET accredited CAAE program,
2. The undergraduate degree is not engineering but in a closely related curriculum with a substantial engineering science content,
3. Deficiencies revealed in the analysis of the undergraduate transcript may be removed by the inclusion of no more than 12 semester credit hours.

A student admitted provisionally would be required to meet with a graduate program coordinator to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate preparation for graduate study. All provisionally admitted students must earn a 3.0 grade point average on the first nine graduate course credits completed. In addition, a 3.0 grade point average must be earned on all undergraduate courses if any were required as a condition of admission.

Students who do not hold an engineering undergraduate degree may have course deficiencies exceeding 12 semester credits. These students can be considered for special student status until such time that their deficiencies are reduced so that they can qualify for provisional admission. Persons with massive undergraduate deficiencies, even though they might hold an undergraduate degree, are asked to apply as transfer students to the undergraduate Civil Engineering program. Make-up courses will be evaluated on a case-by-case basis dependent on the student's area of interest.

Students who are not seeking a graduate degree at NC A&T are also classified as special students. They are admitted to take courses for self-improvement. If a student subsequently wishes to pursue a degree program, he/she must request an evaluation of his/her record. The School of Graduate Studies reserves the right to refuse to accept credits earned while being enrolled as a special student towards a degree program; under no circumstances may the student apply towards a degree program more than twelve semester hours of graduate credits earned as a special student.

In addition to the above application material, foreign nationals or people whose mother tongue is not English are required to provide special information concerning English proficiency and finances. Specifically, these applicants are required to take the standardized "Test of English as a Foreign Language" (TOEFL) and achieve a minimum score of 550.

The School of Graduate Studies accepts application from students who already hold a Master's degree in other fields or disciplines, but wish to earn a MSCE degree. Consistent with NC A&T's School of Graduate Studies' policy, applicants holding a Master's degree in another engineering discipline from NC A&T need only complete 18 credit hours to earn a MSCE degree. If the applicant holds an engineering Master's degree from outside NC A&T, a maximum of 6 credit hours of course work may be transferred.

GENERAL DEPARTMENTAL REQUIREMENTS

A student pursuing a Master of Science in Civil Engineering has the following three options:

- 1) All course work option
- 2) Project option, and
- 3) Thesis option

All students pursuing a Master of Science in Civil Engineering must complete at least one (1) course of the group of Core Courses, six credit hours of advanced math courses (or equivalent math courses), and must enroll in the Master's Seminar (CIEN 792) every semester in residence.

Civil Engineering Core Courses

CIEN 644 Finite Element Analysis
CIEN 700 Emerging Technologies in Civil Engineering
CIEN 702 Civil Engineering System Analysis
CIEN 721 Advanced Soil Testing for Engineering Purposes

Requirements of the Different Options

All options require a minimum of thirty (30) credit hours and the formation of a formal graduate committee. The graduate committee will consist of the advisor and two additional faculty members selected in agreement between the advisor and the student. The plan of study should be prepared by the student and must be approved by the graduate committee. Specifically, only the courses approved by the graduate committee can be used to satisfy the minimum requirements set forth as "approved course work." At least half of the credit hours counted in the "approved course work" to satisfy the requirements for a master's degree must be 700 level courses, that is, courses open only to graduate students. Furthermore, courses numbered 790 and above cannot be used to satisfy the "approved course work" requirements, with the only exceptions as listed below:

All Course Work Option: This option requires thirty (30) credit hours of "approved course work" plus a comprehensive examination that would be administered by the student's graduate committee during the last semester in residence.

Project Option: The project option requires twenty-seven (27) credit hours of "approved course work. This option is intended for students wishing to investigate a design problem of

current interest to industry or to pursue a practical application. These students will have to demonstrate to the committee their capacity to perform and report work adequately.

Thesis Option: This option requires twenty-four (24) credit hours of “approved course work” and six (6) credit hours of Master’s Thesis (CIEN 797). The student’s graduate committee must formally examine the thesis content and quality, and judge the thesis defense. Furthermore, thesis MUST follow the format required by the School of Graduate Studies.

Grades Required

Grades for graduate students are recorded as follows: A, excellent; B, average; C, below average, but permissible; D, clearly below average and not acceptable; F, failure; S, satisfactory; U, unsatisfactory (all courses CIEN 792 through CIEN 797 will be assigned S or U and will not be counted in the student’s GPA); I, incomplete; W, withdrawal. The following academic requirements are in effect:

1. To earn a degree, a student must have a cumulative average of “B” (3.0 on the 4.0 system).
2. A graduate student is automatically placed on “warning” when his/her cumulative average falls below “B”. The student has one semester to raise his/her average to “B” or above or be placed on Probation. Probationary status will remove a student’s eligibility for a teaching assistantship.
3. A student may be dropped from the degree program if he/she has not achieved a cumulative GPA of 3.0 at the end of the probationary semester.
4. A student may not repeat a required course in which “C” or above was earned.
5. A student may repeat a required course in which “F” was earned. A student may not repeat the course more than once. If a student achieves less than “C” the second time, he/she is dismissed from the degree program.
6. All hours attempted in graduate courses and all grade points earned are included in the computation of the cumulative average of a graduate student.
7. A student who stops attending a course but fails to withdraw officially will be assigned a grade of “F”
8. All grades of “I” must be removed during the following semester within the prescribed time period.
9. Changing the selected option, for example from thesis to project, requires approval of the Graduate advisor and the Graduate Program Coordinator and may lead to loss of credit for thesis or project credits.

The graduate program must be completed within six (6) consecutive calendar years.

Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for outdated work. In the event that studies are interrupted for duty in the armed services, the time limit shall be extended for the length of time the student shall have been on active duty providing the candidates resumes graduate work no later than one year following release from military services.

Advanced Undergraduate/Graduate Courses

Course	Title	Credit
CIEN 600	Expert Systems Applications in Civil Engineering	3 (3-0)
CIEN 610	Water and Waste/water Analysis	3 (3-0)
CIEN 614	Stream Water Quality Modeling	3 (3-0)
CIEN 616	Solid Waste Management	3 (3-0)
CIEN 618	Air Pollution Control	3 (3-0)
CIEN 620	Foundation Design I	3 (3-0)
CIEN 622	Soil Behavior	3 (3-0)
CIEN 624	Seepage and Earth Structures	3 (3-0)
CIEN 626	Soil and Site Improvement	3 (3-0)
CIEN 628	Applied Geotechnical Engineering Analysis and Design	3 (3-0)
CIEN 630	Advanced Construction Materials	3 (1-6)
CIEN 640	Advanced Structural Analysis	3 (3-0)
CIEN 641	Design of Reinforced Concrete Structures	3 (3-0)
CIEN 642	Design of Prestressed Concrete Structures	3 (3-0)
CIEN 644	Finite Element Analysis I	3 (3-0)
CIEN 646	Structural Design in Steel	3 (3-0)
CIEN 648	Structural Design in Wood	3 (3-0)
CIEN 650	Geometric Design in Highways	3 (3-0)

CIEN 652	Urban Transportation Planning	3 (3-0)
CIEN 656	Traffic Engineering	3 (2-2)
CIEN 658	Pavement Design	3 (3-0)
CIEN 660	Water Resources System Analysis	3 (3-0)
CIEN 662	Water Resources Engineering	3 (3-0)
CIEN 664	Open Channel Flow	3 (3-0)
CIEN 668	Subsurface Hydrology	3 (3-0)
CIEN 670	Construction Engineering and Management	3 (3-0)
CIEN 699	Special Projects	3 (3-0)
CIEN 700	Emerging Technologies in Civil Engineering	3 (3-0)
CIEN 702	Civil Engineering Systems Analysis	3 (3-0)
CIEN 710	Hazardous Waste Management	3 (3-0)
CIEN 712	Systems Approach in Waste Management	3 (3-0)
CIEN 720	Theoretical Soil Mechanics	3 (3-0)
CIEN 721	Advanced Soil Testing for Engineering Purposes	3 (3-0)
CIEN 722	Design of Reinforced Earth Structures	3 (3-0)
CIEN 724	Constitutive Modeling for Geological Media	3 (3-0)
CIEN 726	Foundation Design II	3 (3-0)
CIEN 729	Geotechnical Aspects of Earthquake Engineering	3 (3-0)
CIEN 730	Reinforced Concrete II	3 (3-0)
CIEN 731	Steel Structures II	3 (3-0)
CIEN 732	Matrix Analysis of Structures	3 (3-0)
CIEN 733	Advanced Reinforced Concrete	3 (3-0)
CIEN 734	Advanced Structural Steel	3 (3-0)
CIEN 735	Wind & Earthquake Design	3 (3-0)
CIEN 736	Facility Planning and Site Analysis	3 (3-0)
CIEN 737	Computer-Aided Project Management	3 (3-0)
CIEN 738	Energy Management Planning	3 (3-0)
CIEN 739	Advanced Energy Conservation Systems	3 (3-0)
CIEN 740	Energy Maintenance and Management	3 (3-0)
CIEN 741	Professional Practice and Labor Relations	3 (3-0)
CIEN 752	Public Transportation Systems	3 (3-0)
CIEN 754	Modeling of Transportation Systems	3 (3-0)
CIEN 756	Highway Operations and Safety	3 (3-0)
CIEN 766	Design of Hydraulic Structures and Machinery	3 (3-0)
CIEN 785	Selected Topics	1 (1-0), 2 (2-0), 3 (3-0)
CIEN 786	Special Projects	1 (1-0), 2 (2-0), 3 (3-0)
CIEN 792	Civil Engineering Master's Seminar	1 (1-0)
CIEN 793	Master's Supervised Teaching	3 (3-0)
CIEN 794	Master's Supervised Research	3 (3-0)
CIEN 796	Master's Project	3 (3-0)
CIEN 797	Master's Thesis	3 (3-0)

CIVIL ENGINEERING COURSE DESCRIPTIONS

Advanced Undergraduate and Graduate

CIEN-600. Expert Systems Applications in Civil Engineering **Credit 3 (3-0)**

Introductory overview of artificial intelligence with an emphasis on Civil Engineering applications: What they are, how they are applied today, a discussion of when they should and should not be used and what goes into building them. Emphasis is on: task selection criteria, knowledge acquisition and modeling, expert system architectures (control and representation issues), and testing and validation. Course requirements will include the design and development of a working system in a chosen application area.

CIEN-610. Water and Waste/water Analysis **Credit 3 (3-0)**

Laboratory and field methods for the measurements and analysis of water.

CIEN-614. Stream Water Quality Modeling **Credit 3 (3-0)**

Mathematical modeling of water quality in receiving streams. Topics include: The generation

of point and nonpoint sources of pollutants; the modeling and prediction of the reaction, transport and fate of pollutants in the stream; and the formulation and solution of simulation models.
(Spring)

CIEN-616. Solid Waste Management **Credit 3 (3-0)**

This course is the study of collection, storage, transport and disposal of solid wastes. Examination of various engineering alternatives with appropriate consideration for air and water pollution control and land reclamation are emphasized. (Fall)

CIEN-618. Air Pollution Control **Credit 3 (3-0)**

Introduction to air pollution and its control. Topics include: sources, types, and characteristics of air pollutants; air quality standards; and engineering alternatives for achieving various degrees of air pollution control.

CIEN-620. Foundation Design I **Credit 3 (3-0)**

This course will introduce the following topics: behavior and design of retaining walls and shallow foundations; earth pressure; bearing capacity and settlement; stress distribution and consolidation theories; settlement of shallow foundations.

CIEN-622. Soil Behavior **Credit 3 (3-0)**

This course will introduce the following topics: behavior of soil examined from a fundamental perspective; review of methods of testing to define response, rationale for choosing shear strength and deformation parameters for soils for design applications.

CIEN-624. Seepage and Earth Structures **Credit 3 (3-0)**

This course will introduce the following topics: seepage through soils; permeability of soils; embankment design; compaction; earth pressures and pressures in embankments; slope stability analysis; settlements horizontal movements in embankments; and landslide stabilization.

CIEN-626. Soil and Site Improvement **Credit 3 (3-0)**

This course will introduce the following topics: methods of soil and site improvement; design techniques for dewatering systems; grouting; reinforced earth; in-situ densification; stone columns; slurry trenches; the use of geotextiles. Construction techniques for each system are described.

CIEN-628. Applied Geotechnical Engineering Analysis and Design **Credit 3 (3-0)**

Introductory course in subsurface hydrology including: Principles of fluid (water) in saturated and unsaturated materials, well hydraulics, various methods of subsurface water flow systems, infiltration theory, and schemes for ground water basin management.

CIEN-630. Advanced Construction Materials **Credit 3 (1-6)**

This course covers Construction Materials advanced topics. It includes the chemistry, biology, physics, microstructure and macrostructure of many materials used in construction. Plastics, Portland cement concrete, asphalt cement and asphalt cement concrete, rubber, glazing, masonry, insulation materials, and wood are all covered in some detail. The relationship between materials and their appropriate use in service is stressed. There is substantial hands-on laboratory work involved, including mixing and testing.

CIEN-640. Advanced Structural Analysis **Credit 3 (3-0)**

This course is a continuation of CIEN-340 emphasizing the more complex concepts of structural analysis for determinate and indeterminate structural systems using both hand calculations and computer applications.

CIEN-641. Design of Reinforced Concrete Structures **Credit 3 (3-0)**

This course is a continuation of CIEN-540 emphasizing the more complex concepts of reinforced concrete design. The design of continuous beams, two slabs and beams columns are addressed.

CIEN-642. Design of Prestressed Concrete Structures **Credit 3 (3-0)**

This course uses the ACI and AASHTO codes to analyze and design prestressed concrete structures.

CIEN-644. Finite Element Analysis I **Credit 3 (3-0)**

Analysis of continuous structural systems as assemblages of discrete elements. Applications of the finite element method is made to the general field of continuum mechanics. Convergence properties and numerical techniques are discussed.

CIEN-646. Structural Design in Steel **Credit 3 (3-0)**

This course uses the AISC code to analyze and design steel structures.

CIEN-648. Structural Design in Wood **Credit 3 (3-0)**

This course uses the wood product code to analyze and design wood structures.

CIEN-650. Geometric Design of Highways **Credit 3 (3-0)**

This course deals with the development and application of geometric design concepts for rural systems. Topics include: functional classifications, design controls and criteria, elements of design, cross section elements, and intersection design.

CIEN-652. Urban Transportation Planning **Credit 3 (3-0)**

This course introduces urban transport planning using a decision-oriented approach. Discussions focus on the decision-making process, data requirements, evaluation processes, systems performance analysis and program implementation.

CIEN-656. Traffic Engineering **Credit 3 (2-2)**

Theory and practice of the operation aspects of Transportation Engineering. Specific applications will deal with the operation, design, and control of highways and their networks. Topics include: data collection techniques, traffic flow theory, and various highway capacity methods and their theoretical basis and the various application software available for each topic.

CIEN-658. Pavement Design **Credit 3 (3-0)**

Application of multilayer theories for design of highways and airport pavement structures. Flexible and rigid pavement design methods are covered with discussions focusing on their theoretical basis and their major differences. Topics include: cost analysis and pavement selection, drainage, earthwork, pavement evaluation, and maintenance.

CIEN-660. Water Resources System Analysis **Credit 3 (3-0)**

Mathematical modeling techniques. Formulation of mathematical representations of complex water resources systems and their evaluation via linear programming, dynamic programming, non-linear programming, and by the use of formal heuristics. Models for optimal sewer design, optimal sequencing (or capacity expansion) of projects, reservoir systems planning and management are presented.

CIEN-622. Water Resource Engineering **Credit 3 (2-2)**

This course involves the application of hydrologic and hydraulic principles in the analysis and design of water resources systems. The measurement of ground water parameters and general water quality parameters is covered. Topics covered include; water supply and distribution, reservoirs, water resources system economics, water law, hydroelectric power, flood control, water resources planning and development and drainage.

CIEN-664. Open Channel Flow **Credit 3 (3-0)**

Advanced topics in open channel flow, design of open channels for uniform and nonuniform flow, wave interference, roughness effects, flow over spillways, water surface profiles, and energy dissipation methods. Some computational methods in open channel flow are presented.

CIEN-668. Subsurface Hydrology **Credit 3 (3-0)**

Introductory course in subsurface hydrology including: principles of fluid (water) in saturated and unsaturated materials, well hydraulics, various methods of subsurface water flow systems, infiltration theory, and schemes for ground-water basin management.

CIEN-670. Construction Engineering and Management **Credit 3 (3-0)**

This course concentrates on the solution to problems in Construction Engineering and Management. A variety of problems from the construction industry are presented to the students. The students form teams to develop solutions to these problems. Topics vary with available projects and student interest. Graduate students select a project in their area of interest for intensive study and a report.

CIEN-699. Special Projects **Credit 3 (3-0)**

Study arranged on a special civil engineering topic of interest to the student and faculty. Topics may be analytical and/or experimental with independent study encouraged.

GRADUATE STUDENTS ONLY

CIEN-700. Emerging Technologies in Civil Engineering **Credit 3 (3-0)**

Provides an overview of the applications of emerging technologies (such as decision support systems and Geographic Information Systems) in civil engineering. The students are required to complete a project which includes the design and implementation of one of the types of systems covered in the course.

CIEN-702. Civil Engineering Systems Analysis **Credit 3 (3-0)**

Introduces mathematical modeling techniques for the solution of civil engineering problems. These include the formulation of mathematical representation of complete civil engineering systems and their evaluation via linear programming, dynamic programming, non-linear programming and the use of formal heuristics. Multiobjective analysis, project management and civil engineering planning and design are also presented.

CIEN-710. Hazardous Waste Management **Credit 3 (3-0)**

Presents a study of the characteristics, treatment, and disposal of hazardous wastes. The topics include the: the generation and characteristics of hazardous waste, hazardous waste regulations, transport and fate of hazardous waste in the environment and treatment and disposal methods. (Fall)

CIEN-712. Systems Approach in Waste Management **Credit 3 (3-0)**

Introduces the application of systems analysis methods to the design, analysis and management of environmental systems. The topics include: characteristics of a system, problems amenable to systems analysis, optimization models, solution techniques, and case studies in solid waste management, hazardous waste management, and water quality management. (Spring)

CIEN-720. Theoretical Soil Mechanics **Credit 3 (3-0)**

Presents the different theories of consolidation, such as Terzaghi's Theory, layered systems, sand drains, approximate three-dimensional theories, and Biot's poroelastic formulation. The course will also present theories of elastic and plastic equilibrium in soils including applications to earth pressure, bearing, bearing capacity, and slope stability problems.

CIEN-721. Advanced Soil Testing for Engineering Purposes **Credit 3 (1-6)**

This course allows students to gain laboratory experience with the methods of testing soils for engineering properties such as compressibility, strength (in triaxial, simple shear, and direct shear), permeability, and stability.

CIEN-722. Design of Reinforced Earth Structures **Credit 3 (3-0)**

Introduces the student to the interaction mechanisms of soil with reinforcement elements. The applications covered will include the following: reinforced earth, soil nailing, and geotextile/geofabric strengthening of pavement structures.

CIEN-724. Constitutive Modeling for Geological Media **Credit 3 (3-0)**

Introduces the following topics: constitutive models for geological media including piecewise linear; Mohr-Coulomb; Hvorslev's and Roscoe's concepts; role in modeling of in-situ stress; sequential construction and stress paths; lateral pressure coefficients; dilatation and softening; arching; pore water pressure; joints and interfaces; and Darcy and non Darcy Laws.

CIEN-726. Foundation Design II **Credit 3 (3-0)**

Introduces the analysis and design of foundations and other substructures including the following: concrete footings with reinforcement; pile foundations; retaining walls; pavements, load transfer in rail track beds; cofferdams; caissons and underground structures and openings.

CIEN-729. Geotechnical Aspects of Earthquake Engineering **Credit 3 (3-0)**

Introduces the student to the following earthquake related topics: response of soils to seismic loading; liquefaction phenomena and analysis of pore pressure development; laboratory testing for seismic: including direct laboratory experience. The course will also provide instruction on the analysis and design of slopes, embankments, foundations, and earth retaining structures for seismic loading conditions.

CIEN-730. Reinforced Concrete II **Credit 3 (3-0)**

This course is a continuation of CIEN 636 emphasizing the more complex concepts of reinforced concrete theory and their application to design. The analysis and design of special concrete structures will be addressed. Prerequisite: Graduate standing and CIEN 636 or consent of the instructor.

CIEN-731. Structural Steel II **Credit 3 (3-0)**

The design of composite structures, built-up beams, portal frames, and gabled frames are presented. Also addressed are the concepts of limit and plastic design. Prerequisites: Graduate standing and CIEN 635 or consent of the instructor.

CIEN-732. Matrix Analysis of Structures **Credit 3 (3-0)**

This course reviews Matrix algebra; statically and kinematically indeterminate structures. The student is introduced to the flexibility and stiffness methods as it applies to beams, plane trusses and plane frames. Prerequisite: Graduate standing and CIEN 630 or consent of the instructor.

CIEN-733. Advanced Reinforced Concrete **Credit 3 (3-0)**

This course is a continuation of CIEN 726 emphasizing the design of reinforced concrete structures. The analysis and design of reinforced concrete structures will be addressed. Prerequisite: Graduate standing and CIEN 726 or consent of the instructor.

CIEN-734. Advanced Structural Steel **Credit 3 (3-0)**

This course is a continuation of CIEN727 emphasizing the design of steel building structures. The analysis and design of steel structures will be addressed. Prerequisites: Graduate standing and CIEN 727 or consent of the instructor.

CIEN-735. Wind and Earthquake Design **Credit 3 (3-0)**

The course applies the principles of structural dynamics to determine the response of buildings to earthquake and wind induced forces. The response spectra is used to evaluate earthquake forces on the building. The behavior of wind and the variation in wind velocity are studied with respect to topography and the building height above ground. The course also investigates the response of building components to hurricanes and tornadoes. Prerequisites: Graduate standing and CIEN 603.

CIEN-736. Facility Planning and Site Analysis. **Credit 3 (3-0)**

The course includes strategic and long-range planning concepts, environmental impact studies, population and growth projections. Accessibility, storm water retention, and economics are also discussed. Prerequisite: Graduate standing and consent of the instructor.

CIEN-737. Computer-Aided Project Management. **Credit 3 (0-6)**

This course uses computer-aided analysis and design in project scheduling, manpower forecasting, cash flow analysis, progress reports, billings and profitability analysis. The emphasis is on the application of micro-computers in the management of a small consulting firm. Prerequisite: Graduate standing and consent of the instructor.

CIEN-738. Energy Management Planning **Credit 3 (3-0)**

The course presents concepts of energy management planning for multi-building complexes such as universities, hospitals, and schools. Topics include data collection and analysis, facility audits, on-site metering, and the review of maintenance records and utility bills. Prerequisite: Graduate standing and consent of the instructor.

CIEN-739. Advanced Energy Conservation Systems **Credit 3 (3-0)**

The course includes advanced topics in energy conservation including thermal storage, district heating and cooling, waste heat recovery, and co-generation. Prerequisite: Graduate standing and consent of the instructor.

CIEN-740. Energy & Maintenance Management **Credit 3 (3-0)**

The course deals with computerized energy accounting methodologies and computerized maintenance management methodologies. The students will apply computer programs to an actual building in order to obtain real-world experience in program application. Prerequisite: Graduate standing and consent of the instructor.

CIEN-741. Professional Practice and Labor Relations **Credit 3 (3-0)**

The course deals with the legal aspects of engineering consulting and commercial construction. Topics include contracts, employment standards, collective bargaining, resolving labor disputes and the Occupational Safety & Health regulations. Prerequisite: Graduate standing and consent of the instructor.

CIEN-752. Public Transportation Systems **Credit 3 (3-0)**

Exposes the student to the technologies, design, operation, planning, evaluation, management and implementation of public transportation systems. The following systems are considered: rail, fixed-route, fixed-schedule bus, and demand responsive services. The topics include the following: financing and regulation, supply and demand relationships, performance evaluation, routing and scheduling, and microcomputer applications.

CIEN-754. Modeling of Transportation Systems **Credit 3 (3-0)**

This course is concerned with the development and use of system models associated with transportation decision making. The modeling techniques that will be used are the following: multiple linear regressions, choice theory and network simulation. The application areas considered are the following: traffic flow theory, planning models, urban transit planning and operations, and the evaluation alternatives.

CIEN -756. Highway Operations and Safety **Credit 3 (3-0)**

This course will present a discussion of the policies, laws and programs relating to highway safety in the United States. The topics of discussion presented include a historical overview of highway safety, the government's role (at all levels), a description and status of current safety programs, the analytical techniques used by the traffic safety engineer (practical problems, data requirements, limitations), and some of the moral/ethical issues of concern to the Safety Engineer.

CIEN-766. Design of Hydraulic Structures and Machinery **Credit 3 (3-0)**

Presents the analysis and design of water regulating structures including dams, spillways, outlet works, transition structures, conduit systems and gates. The course will also present the applications of basic principles of fluid mechanics and hydraulics to the design and selection of pumps, turbine, and other hydraulic machinery.

CIEN-785. Selected Topics **Credit 1 (1-0), 2 (2-0), 3 (3-0)**

Allows a student to select a civil engineering topic of interest to the student to investigate in depth. The topic will be selected by the student and a faculty advisor before the beginning of the semester. The topic must be pertinent to the study program of the student and must be approved by the faculty advisor.

CIEN-786. Special Projects **Credit 1 (1-0), 2 (2-0), 3 (3-0)**

Student must select a project on a special civil engineering topic of interest to the student and a faculty member, who will act as an advisor. The student and faculty advisor must agree upon

the project and scope of work before the beginning of the semester. The project may be analytical and/or experimental and encourage independent work. The topic must be pertinent to the program in which the student is enrolled and approved by the faculty advisor. (Fall, Spring)

CIEN-792. Civil Engineering Master's Seminar **Credit 1 (1-0)**

Discussion and presentations of reports of subjects in Civil Engineering and allied fields are included.

CIEN-793. Master's Supervised Teaching **Credit 3 (3-0)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

CIEN-794. Master's Supervised Research **Credit 3 (3-0)**

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty.

CIEN-796. Master's Project **Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students.

CIEN-797. Master's Thesis **Credit 3 (3-0)**

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Master's Thesis. This course is only available to thesis option students.

Computational Science and Engineering M.S. Program

Ajit D. Kelkar, Interim Director
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www.eng.ncat.edu/idp/cse

OBJECTIVES

The program is designed with the following objectives:

1. To educate graduate students with a mastery of high performance computer programming tools as well as processing, data acquisition, and analysis techniques.
2. To educate and train students in computational modeling, simulation and visualization.
3. To assist students to relate acquired computational science and engineering knowledge and skills to specific application fields of engineering, science, technology and business.
4. To teach students to develop novel and robust computational methods and tools to solve scientific, engineering, and technological and business problems.
5. To produce highly versatile computational scientists, engineers, technologists, or business executives with a good understanding of the connections among various disciplines, capable of interacting and collaborating effectively with scientists, engineers, and professionals in other fields.
6. To increase the number of graduate professionals available to work in computational science and engineering.
7. To increase the diversity of graduate professionals, especially underrepresented minority and African Americans available to work in the computational science and engineering field.
8. To assist the State of North Carolina and the nation to increase the pool of graduates with training and experience in computational science and engineering, interdisciplinary applications and research.

GENERAL PROGRAM ADMISSION REQUIREMENTS

Candidates seeking admission to the CSE Program for the Master of Science degree must meet the following requirements:

1. Computational Science and Engineering track: Bachelor's degree in engineering, physics, computer science, or mathematics from an accredited program with a minimum cumulative GPA of 3.0/4.0.
2. Computational Science track: Bachelor's degree in Chemistry, Biology, Business and Agricultural Sciences with a minimum cumulative GPA of 3.0/4.0.
3. Computational Technology track: Bachelor's degree in Technology or related field with a minimum cumulative GPA of 3.0/4.0.
4. A completed Graduate Record Exam (GRE) General Test as applicable to the discipline area of the student.
5. Official TOEFL scores of at least 550 or better (213 computer-based score) for students whose native language is other than English. Scores should be submitted directly to the School of Graduate Studies.
6. General prerequisites: (1) Calculus through differential equations for the computational science and engineering track, (2) college chemistry and physics, (3) elementary numerical analysis, (4) one semester of linear algebra for the computational science and engineering track. These are in addition to the courses in the student's principal bachelor degree discipline. Programming and working knowledge of at least one high level programming language such as FORTRAN, C++, or Java is also required for the computational science and engineering track, and recommended for other tracks depending on the student's area of interest. There may also be additional recommended or required prerequisites specific to the needs of a focus area.

Documentation Requirements

The following documents are to be submitted by all applicants.

1. Two official transcripts of all college-level academic work.
2. Three letters of recommendation (for study at the graduate level) from professional associates or supervising faculty/professors from the degree granting institution.
3. An official copy of the GRE scores mailed directly to the University from the testing agency.
4. An official copy of the TOEFL score, if applicable, mailed directly to the University from the testing agency.
5. The completed application form and application fee stipulated by the School of Graduate Studies at NC A&T State University.
6. A “Statement of Purpose” in the context of pursuing the M.S. degree in Computational Science and Engineering.

Computational Science and Engineering Tracks

Computational Science and Engineering

This track is designed primarily for students with undergraduate degrees in engineering, physics, mathematics, and computer science who will be trained to develop problem-solving methodologies and computational tools as well as interdisciplinary technical expertise in CSE for solving challenging problems in physical science, engineering, applied mathematics or computer science. This includes domains that are both in the College of Engineering, and the College of Arts and Sciences. The curriculum will emphasize computational sciences and engineering along with training in the domain areas. The goal of this track is to produce scientists and engineers with focus, training and application in computational sciences, scalable computing, physics-based modeling and simulations, and with expertise in the application of computational techniques and principles in their primary domain areas. Qualified undergraduate students can be admitted to this stream if they also meet the admission criteria of their major domain field. Based on their undergraduate degrees, the students in this track would be required to have had an increased level of prior training, courses and exposure to mathematics, including areas such as numerical analysis, and high level programming languages. Students with undergraduate degrees in other science and technology areas may also be admitted, if they meet the admission and course requirements, including prerequisites of the domain department. The areas of specialization will include, but will not be limited to, computational quantum chemistry, computational nuclear and high energy physics, computational solid or fluid dynamics, computational material science, bioengineering, engineering design and automation, applied and environmental geophysics, computational seismology, nonlinear computational mechanics, super fast algorithms for numerical and algebraic computation, and distributed and high performance computing.

Computational Sciences

This track is designed primarily for students with undergraduate degrees in chemistry, biology, business, and agricultural sciences who will be trained to apply or extend computational tools and methods as well as data acquisition, processing and visualization techniques to study computationally intensive problems in life sciences, agricultural and environmental sciences, and business and economics. This track primarily includes domain areas with lesser training in mathematics including numerical analysis, and programming languages and focuses on domains with non-deterministic models. The domains in this track are for the College of Arts and Sciences, the School of Agriculture and Environmental Sciences and the School of Business and Economics. The goal of this track is to produce biological and life scientists, business professionals and economists, and agricultural scientists with focus and expertise in computational sciences and the primary domain areas. Qualified undergraduate students can be admitted to this stream if they also meet the admission criteria of the major domain area. Based on their undergraduate field, the students in this track would be required to take additional mathematics and programming focused courses. Students with undergraduate degrees in other science, engineering and technology areas may also be admitted if they meet the admission and course requirements, including prerequisites for the domain department. The areas of specialization will include, but will not be limited to, bioinformatics, computational genomics, computational physical chemistry, computational biochemistry, and computational finance.

Computational Technology

This track is designed primarily for students with undergraduate degrees in technology disciplines with a focus on computational science and engineering. These technology disciplines currently include computation technology, computer numerical control machining, remote sensing, GIS/GPS data analysis, and nanotechnology with additional potential disciplines in the future. The goal of this track is to produce technologists with a focus and training in computational sciences, and in their primary technology domain area. Students with

undergraduate degrees in engineering, mathematics, physics and computer science may also be admitted and must meet the course and curriculum requirements in technology.

PROGRAM OPTIONS AND DEGREE REQUIREMENTS

The program requires 34 credit hours at the graduate level beyond the undergraduate degree distributed as follows:

Thesis Option:

27 credit hours for course work at the graduate level,
1 credit hour for seminars, and
6 credit hours for thesis research.

Project Option:

30 credit hours for course work at the graduate level,
1 credit hour for seminars, and
3 credit hours for graduate masters project.

Year One

Fall Semester

CSE 701 - Applied Probability and Statistics	3cr
CSE 702 - Comprehensive Numerical Analysis	3cr
Domain course I	3cr

Spring Semester

CSE 703 - Data Structures, Software Principles and Programming in Scalable Parallel Computing.	3cr
CSE 704 - Computational Modeling and Visualization	3cr
Domain course II	3cr

Year Two

Fall Semester

Interdisciplinary course I	3cr
Interdisciplinary course II	3cr
Interdisciplinary course III	3cr (for project option)
Thesis	3cr (for thesis option)
Seminar	1cr

Spring Semester

Domain course III	3cr
Thesis	3cr (for thesis option)
Master's Project	3cr (for project option)

All students irrespective of the track that they are registered in must complete the core courses CSE-701, CSE-702, CSE-703 and CSE-704.

All students must complete the Graduate Seminar course CSE 792, which accounts for 1 credit hour.

Students pursuing the thesis option must complete 6 credits hours of CSE 797.

Students pursuing the project option must complete 3 credits hours of CSE 796.

A list of Domain courses and Interdisciplinary courses from which a student can choose based on the track the student is registered in is as follows;

Computational Science and Engineering Track

Domain Courses:

Mechanical: MEEN 618, MEEN 655, MEEN 716, MEEN 719

Civil: CIEN 614, CIEN 668, CIEN 644, CIEN 660, CIEN 662, CIEN 664, CIEN 700, CIEN 702, CIEN 754

Industrial: INEN 665, INEN 721, INEN 742, INEN 813, INEN 814, INEN 822, INEN 841, INEN 843, INEN 844, INEN 853

Computer Science: COMP 670, COMP 732, COMP 733, COMP 755, COMP 770, COMP 785

Electrical: ELEN 674, ELEN 678, ELEN 749, ELEN 762, ELEN 764, ELEN 821, ELEN 857, ELEN 862, ELEN 865, ELEN 867, ELEN 870, ELEN 871

Chemical: CHEN 630, CHEN 620, CHEN 640, CHEN 710, CHEN 720, CHEN 730, CHEN 740, CHEN 760

Physics: PHYS 735, PHYS 605, PHYS, 737, PHYS 738, PHYS 739, PHYS 743, PHYS 751

Math: MATH 608, MATH 624, MATH 652, MATH 706, MATH 712, MATH 723

Interdisciplinary Elective Courses:

PHYS 745, PHYS 746, BIOL 705, BIOL 706, MEEN 655, MEEN 716, PHYS 791, MATH 791, CSE 711, CSE 712, CSE 713 or any other qualifying domain courses that are not from the major domain area of the student. Students registered for the thesis option must complete 6 credit hours of course work from this list and students registered for the project option must complete 9 credit hours of course work from this list.

Computational Science Track

Domain Courses:

Chemistry: CHEM 651, CHEM 652, CHEM 643, CHEM 772, CHEM 741, CHEM 742, CHEM 745, CHEM 746, CHEM 755, CHEM 756

Agribusiness and Science: AGECE 638, AGECE 675, AGECE 705, AGECE 708, AGECE 740, AGECE 756

Animal Sciences: ANSC 637, ANSC 665, ANSC 771, ANSC 782

Human Environment and Family Sciences: HEFS 653

Natural Resources and Environmental Design: SLSC 632, NARS 610, AGRI 604

Biology: BIOL 632, BIOL 642, BIOL 665, BIOL 700, BIOL 703, BIOL 704

Business and Economics : BUAD 715, BUAD 713, BUAD 712, ECON 706, ACCT 708, ACCT 714, BUAD 730, BUAD 731, BUAD 732, BUAD 733, BUAD 734, BUAD 735, BUAD 736, TRAN 701, TRAN 720, TRAN 725, TRAN 727, TRAN 730

Interdisciplinary Elective Courses:

PHYS 745, PHYS 746, BIOL 705, BIOL 706, MEEN 655, MEEN 716, PHYS 791, MATH 791, CSE 711, CSE 712, CSE 713 or any other qualifying domain courses that are not from the major domain area of the student. Students registered for the thesis option must complete 6 credit hours of course work from this list and students registered for the project option must complete 9 credit hours of course work from this list.

Computational Technology

Domain Courses:

Electronics and Computer Technology and Manufacturing Systems: ECT 600, ITT 634, ECT 635, ITT 650, ITT 665, ITT 670, ITT 680, ECT 765, ECT 770, MFG 651, MFG 674, MFG 710, MFG 760, CSE 711, CSE 712

Interdisciplinary Elective Courses:

PHYS 745, PHYS 746, BIOL 705, BIOL 706, MEEN 655, MEEN 716, PHYS 791, MATH 791, CSE 711, CSE 712, CSE 713 or any other qualifying domain courses that are not from the major domain area of the student. Students registered for the thesis option must complete 6 credit hours of course work from this list and students registered for the project option must complete 9 credit hours of course work from this list.

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

Initially the Director of the program will serve as the academic advisor for all new students entering the program. Each student in the M.S. program is expected to select a major advisor by the beginning of the second semester with the approval of the Director. The major advisor must hold a tenure or tenure-track full-time faculty position at the university. However, a co-advisor may have non-tenure-track/adjunct status. The M.S. Advisory Committee will consist of a minimum of three (3) graduate faculty members with the major advisor as its chairperson. Committee members must be from at least two different departments. Members could represent more than one campus School/College. The M.S. Advisory Committee will be recommended by the major advisor with input from the student to the Director of the CSE program for approval by the Dean of Graduate Studies.

OTHER INFORMATION

See "Requirements for the Master of Science Degree" elsewhere in this catalog for information related to residence requirements, qualifying examination, preliminary examination, final oral examination, admission to

candidacy, and time limit. Additional details of requirements for the program are outlined in the Computational Science and Engineering M.S. Program Student Handbook available from the Graduate School.

List of Courses	Credits
CSE 701 Applied Probability and Statistics	3
CSE 702 Comprehensive Numerical Analysis	3
CSE 703 Data Structures, Software Principles and Programming in Scalable Parallel Computing	3
CSE 704 Computational Modeling and Visualization	3
CSE 711 Nano-Scale Science and Engineering	3
CSE 712 Nano-Scale Technology	3
CSE 713 Multi-Scale and Multi-Physics Modeling	3
M.S. Level Pass/Fail Courses	
CSE 792 Graduate Seminar	1
CSE 796 Masters Project	3
CSE 797 Masters Thesis	3
CSE 799 Continuation of Masters Thesis	1

COURSE DESCRIPTIONS

CSE 701. Applied Probability and Statistics

Credit 3(3-0)

This course addresses probability and statistics theory and techniques with common application in computational science and engineering. Topics include parameter and distribution estimation, random variables and computer generation, hypothesis testing and confidence intervals, regression analysis, and the design of experiments including analysis of variance.

CSE 702. Comprehensive Numerical Analysis

Credit 3(3-0)

This course provides a comprehensive treatment to numerical methods for the solution of equation systems both in deterministic and non-deterministic problems. Both numerical solution techniques for differential equations, linear systems, data analysis, optimization, regression, Monte Carlo methods, forecast models, etc. will be covered.

CSE 703. Data Structures, Software Principles and Programming in Scalable Parallel Computing

Credit 3(3-0)

This course addresses the concepts, principles hardware and software, communication and computational strategies for scalable, parallel computing systems, the associated computer data structures, programming languages and parallel programming paradigms and associated communications for parallel and scalable computing applications in engineering, sciences, and technology.

CSE 704. Computational Modeling and Visualization

Credit 3(3-0)

This course covers computational techniques for solving deterministic physical models in engineering and sciences, as well as computational techniques for non-deterministic models in business, economics, informatics, statistics, etc. It also involves a detailed study of visualization, analysis and interpretation techniques useful in the analysis of numerical data in both deterministic and non-deterministic disciplines, as well as visualization and interpretation software tools.

CSE 711. Nano-Scale Science and Engineering

Credit 3(3-0)

This course explores the fundamental understanding and resulting technological advances arising from the exploitation of new physical, chemical, and biological properties of systems that are intermediate in size between isolated atoms and molecules and bulk materials.

CSE 712. Nano-Scale Technology

Credit 3(3-0)

This course explores the creation and utilization of functional materials, devices, and systems with novel properties and functions that are achieved through the control of matter, atom-by-atom, molecule-by-molecule, or at the macro-molecular level. Nano-scale manufacturing and fabrication requires an entirely new approach: invention of new instruments, measuring tools, models, methods, and standards to characterize nano-scale materials and processes.

CSE 713. Multi-Scale and Multi-Physics Modeling

Credit 3(3-0)

This course focuses on multi-scale, multi-physics modeling approaches, associated computational techniques involving quantum, atomistic, meso, micro, macro models and the coupling of such models and related applications in engineering, materials and physical sciences.

CSE 792. Graduate Seminar

Credit 1(1-0)

Discussions and reports of subjects in Computational Science and Engineering and allied fields will be presented. Prerequisite: Masters level standing.

CSE 796. Masters Project

Credit 3(3-0)

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students. Prerequisite: Masters level standing.

CSE 797. Masters Thesis

Credit 3(3-0)

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Masters thesis. This course is available only to thesis option students and can be repeated. Prerequisite: Consent of advisor.

CSE 799. Continuation of Masters Thesis

Credit 1(1-0)

This course is a continuation of CSE 797. The course is for master's students who have completed all required credit hour requirements. Prerequisite: Completion of all Thesis/Dissertation Credits.

Computer Science

Kenneth A. Williams, Chairperson
Huiming (Anna) Yu, Director of Graduate Studies
508 McNair Hall
(336) 334-7245

OBJECTIVES

The Master of Science Program in Computer Science is designed to meet the need for technical and managerial specialists in research, academia and industry.

DEGREE OFFERED

Computer Science - Master of Science

The MSCS program provides three methods for earning the degree: Thesis (30 credits), Project (33 credits) or course only (33 credits). Unconditional admission to the program is granted to students with a BS in computer science from an accredited program with a minimum GPA of 3.0. Admission may be awarded to promising students from other majors after completing specified undergraduate prerequisites. Specific degree and admission requirements are detailed in the Computer Science Department Graduate Student Handbook.

It is assumed that all entering students have completed undergraduate courses in programming in an object-oriented language (such as C++, Java or Smalltalk), in data structures, algorithm analysis, operating systems and computer architecture. It is also assumed that they are mathematically mature (for example, calculus, discrete math or switching theory). Students who have not had such courses or their equivalent may be required to take undergraduate courses to remedy deficiencies, with no credit towards the degree.

Master's Program General Description

The research interests of the faculty cover many areas of Computer Science including software engineering, information assurance, artificial intelligence, computational science, distributed systems, multiagent systems, computer security, visualization, multimedia input and high performance computing.

Software Engineering:

“The systematic approach to the development, operation, maintenance, and retirement of software” is the definition of software engineering. Software is not only the program code, but includes the various documents needed for the development, installation, utilization, and maintenance of a system. Engineering refers to the application of a systems approach to the production of large software systems. Methodologies for analysis and design are evolving, competing, and themselves being automated through the use of CASE (computer aided software engineering) tools. The methods of software engineering seek to produce systems of high quality, on time, at the lowest costs possible. Research projects include object oriented methodologies, software production cost modeling, software reliability engineering, and the social implications of computer technology.

Artificial Intelligence:

Artificial intelligence uses symbolic computation and complex interrelations of variables to produce “intelligent” responses to problem situations. The responses are intelligent in the sense that unforeseen situations are accommodated and decisions are not hard-coded into programs. Problems are frequently “ill-structured”, that is, they cannot be stated in the forms required by commonly used deterministic and sequential algorithms. Artificial intelligence often involves search and inference and frequently supports human decision making. It is thus natural to view artificial intelligence software as tackling problems as humans would tackle them. Research topics include mobile robots, computer vision, automated reasoning, the acquisition and representation of knowledge, and the analysis of decision making in realistic business settings. Artificial intelligence uses a multitude of paradigms, willingly collaborates with other areas of computer science, and pursues real-world applications.

Computational Science and Engineering:

Computational science is a relatively new branch of science and has emerged as a powerful and indispensable method of analyzing a variety of problems in research, production and process development, and manufacturing. Computational modeling and simulation is being accepted as a third methodology in scientific research, complementing the traditional approaches of theory and experiment. Computational modeling, simulation, and visualization are immensely useful for studying things that are otherwise too big, too small, too

expensive, too scarce, or too inaccessible to study. The rapid growth of information technology and its applications in the job market created a need for multi-skilled workers at all levels, including the master's.

General:

There are several other research areas in the Department of Computer Science. Students can select a research topic from these areas as the project/thesis. Students must consult their advisor to design their curriculum and project/thesis.

The Computer Science Department operates the Software Engineering Laboratory, National Science Foundation and National Security Agency scholarship study laboratory, the NASA Intelligent Agents study group, the NIMA (National Imagery and Mapping Agency) visualization research group, as well as other research funded by agencies including the Naval Oceanographic Office.

LIST OF GRADUATE COURSES

COMP 620	Information, Privacy, and Security
COMP 627	Wireless Network Security
COMP 645	Artificial Intelligence **
COMP 653	Computer Graphics
COMP 662	Computer Aided Instruction
COMP 663	Compiler Construction
COMP 670	Advanced Computer Architecture
COMP 681	Formal Methods #
COMP 700	Independent Study
COMP 710	Software Specification, Analysis and Design ***, #
COMP 711	Software System Design, Implementation, Verification and Validation ***
COMP 712	Software Project Management ***
COMP 713	Social Impacts of Software Systems
COMP 714	Case, Automated Development, and Information Engineering
COMP 715	Decision Support Systems
COMP 716	Object-Oriented Programming and Software Reuse
COMP 717	Software Fault Tolerance
COMP 718	Object Oriented Software Engineering
COMP 723	Intrusion Detection
COMP 732	Advanced Software Tools †
COMP 733	Parallel Computing Applications
COMP 740	Advanced Artificial Intelligence **
COMP 741	Knowledge Representation and Acquisition
COMP 742	Automated Reasoning
COMP 745	Computational Linguistics
COMP 747	Computer Vision Methodologies
COMP 749	Intelligent Robots
COMP 750	Distributed Systems
COMP 753	Performance Modeling and Evaluation
COMP 755	Advanced Operating Systems *
COMP 767	Computer Network Architecture
COMP 770	Computer Organization and Programming for Scientific Computing †
COMP 780	Semantics of Programming Languages
COMP 785	Advanced Design and Analysis of Algorithms *
COMP 786	Multiagent Systems
COMP 790	Special Topics in Computer Science
COMP 792	Computer Science Masters Seminar
COMP 793	Masters Supervised Teaching
COMP 796	Masters Project
COMP 797	Masters Thesis
COMP 999	Continuation Research

* = Core course, required of all students

** = Required for Artificial Intelligence specialization

*** = Required for Software Engineering specialization

† = Required for Computational Science and Engineering specialization

= Required for General specialization

COURSES WITH DESCRIPTION IN COMPUTER SCIENCE

Advanced Undergraduate and Graduate

COMP-620. Information, Privacy and Security

Credit 3 (3-0)

This course examines the security and privacy issues associated with information systems. There are cost/risk tradeoffs to be made. Discussed are topics such as technical, physical, and administrative methods of providing security, access control, identification, and authentication. Encryption is examined, including Data Encryption Standards (DES) and public key cryptosystems. Management considerations such as key protection and distribution, orange book requirements, and OSI data security standards are covered. Privacy legislation is covered, as is current cryptographic research.

COMP-627. Wireless Network Security

Credit 3 (3-0)

This course covers the security issues associated with wireless networks. Emerging wireless technologies, standards and protocols are explored. The course will define and demonstrate various threats to wireless security. Topics include security service, security protocol, and security architecture for wireless. Details of wireless encryption techniques are examined.

COMP-645. Artificial Intelligence

Credit 3 (3-0)

This course presents the theory of artificial intelligence, and application of the principles of artificial intelligence to problems that cannot be solved, or cannot be solved efficiently, by standard algorithmic techniques. Knowledge representation, and Knowledge-based systems. Topics include search strategies, production systems, heuristic search, expert systems, inference rules, computational logic, natural language processing. Predicate calculus is discussed. An artificial intelligence language is presented as a vehicle for implementing concepts of artificial intelligence.

COMP-653. Computer Graphics

Credit 3 (3-0)

This is a course in fundamental principles and methods in the design, use, and understanding of computer graphic systems. Topics include coordinate representations, graphics functions, and software standards. Hardware and software components of computer graphics are discussed. The course presents graphics algorithms. It also introduces basic two-dimensional transformations, reflection, shear, windowing concepts, clipping algorithms, window-to-viewport transformations, segment concept, files, attributes and multiple workstation, and interactive picture-construction techniques.

COMP-662. Computer Aided Instruction

Credit 3 (3-0)

This course provides a conceptual foundation for the development of instructional tools based on a variety of learning theories. Students will learn how to design and implement Computer Aided Instruction (CAI) projects using authoring software. As part of the implementation process, a multimedia programming language will be studied and practiced. The concept of Intelligent Computer Aided Instruction (ICAI) will be introduced.

COMP-663. Compiler Construction

Credit 3 (3-0)

This course emphasizes the theoretical and practical aspects of constructing compilers for computer programming languages. The course covers principles, models, and techniques used in the design and implementation of compilers, interpreters, and assemblers. Topics include lexical analysis, parsing arithmetic expressions and simple statements, syntax specification, algorithms for syntax analysis, object code generation, and code optimization. Each student will develop and implement a compiler.

COMP-670. Advanced Computer Architecture

Credit 3 (3-0)

This is a course that examines the control and storage structures that facilitate the execution and management of logically segmented programs and data. Of special focus are input-output mechanisms, performance tuning, and microprogramming.

COMP-681. Formal Methods

Credit 3 (3-0)

In this course formal methods that model the software development process will be studied. Fundamental and practical methodologies and theories, including set theory and the foundations of software engineering will be emphasized. Applications to formal specifications, object-oriented programming and data modeling will be examined. Topics include: set theory, relations and functions, induction and recursion, symbolic logic, complex models, and application case studies.

GRADUATE STUDENTS ONLY

COMP-700. Independent Study

Credit 3 (3-0)

This course can be used for study of advanced topics in computer science pertinent to the student's interest under supervision of a faculty member. Prerequisite: Permission of Instructor

COMP-710. Software Specification, Analysis and Design

Credit 3 (3-0)

This course examines the formalization of software requirements and the analysis of the flow of data through a proposed large software system. Methodologies covered include Structured Analysis (data flow diagramming), hierarchy charts, entity-relationship data diagrams, procedure specifications, and Information Engineering. Additional methodologies addressed include Jackson Structured Diagrams, Harlan Black Boxes, and Object-Oriented Analysis techniques.

COMP-711. Software System Design, Implementation, Verification and Validation Credit 3(3-0)

This course proceeds from the evaluation of a completed system design for completeness, correctness, information engineering, and functionality. Accepted industry and academic standards for such reviews will be used, for example leveling of data flow diagrams, measures of module cohesion, control structures, and function point estimation. As part of the implementation process, verification and validation methodologies will be studied and practiced. An actual system will be implemented by the end of the semester. Prerequisite: COMP-710.

COMP-712. Software Project Management

Credit 3 (3-0)

This course examines the nature of data processing projects, definitions of purpose, scope, objectives, deliverable dates, and quality standards. Interpersonal interaction and people-oriented management techniques are studied, along with team member measurement and assessment methods. Project management tools such as PERT (Project Evaluation and Review Technique), and CPM (Critical Path Method) are covered. Managerial styles in motivating, innovating, and organizing will be examined, along with techniques for improving these skills. Equipment and software selection and installation guidelines, and the proper use of outside consulting services will be examined.

COMP-713. Social Impacts of Software Systems

Credit 3 (3-0)

This course examines the increasing importance of computer technology in the functionality of our economy, our government, and our industry. Potential impacts upon personal privacy and autonomy are examined in relation to the public policy and social impacts of computer technology. The role and opportunity for historically under-represented technical professionals will be explored. Interdisciplinary readings, written and oral presentations, and in class debates are required. Outside speakers from related disciplines are invited to participate.

COMP-714. CASE, Automated Development and Information Engineering Credit 3 (3-0)

Beginning with the concepts of automated development, various models are reviewed in detail, especially Information Engineering, Methodology assessment approaches are covered, especially the Software Engineering Institute Process Maturity model, and a variety of organizational impacts of technology are examined. Computer Aided Software Engineering (CASE) is covered through tutorial laboratory sessions and a problem assignment. Topics include fundamentals of data analysis, diagramming tools for data modeling process analysis, presentation architecture, communications architecture, data architecture, process architecture, and application construction. Techniques and tools for defining menu structures, screens and screen dialogues, and user interface management systems are studied, as are the general principles of physical design.

COMP-715. Decision Support Systems

Credit 3 (3-0)

This course examines methods of inference under uncertainty and problem-solving strategies as key components of decision support systems. Knowledge based systems, knowledge acquisition and representation, and the planning, design and implementation of computer-assisted decision systems are covered. The interactive use of software for management decision making is examined through examples drawn from decision modeling, simulations, and large-scale commercial applications.

COMP-716. Object-Oriented Programming and Software Reuse

Credit 3 (3-0)

Introduce software reuse principles and reuse driven software development. Reuse techniques will be addressed that include reuse readiness assessment, corporate reuse plan creation and organizing for reuse. Discuss

application package selection, selecting reusable components and identifying candidate reusable components. Teach and use the object-oriented programming language Java, emphasize its object-oriented features and how to use Java to develop reusable components, subsystems and frameworks.

COMP-717. Software Fault Tolerance

Credit 3 (3-0)

The principles, techniques and current practices in the area of fault tolerant computing with an emphasis on system structure and dependability are examined in this course. Major topics include system models, software/hardware interaction, failure and reliability, fault tolerance principles, redundancy, rollback and recovery strategies, and N-version programming. Redundancy in data structures and the validation of fault tolerant software are studied.

COMP-718. Object Oriented Software Engineering

Credit 3 (3-0)

This course covers the concept of the “object-oriented life cycle”, demonstrating a practical methodology for the application of object oriented methods to large projects. The specific problems and solutions for large software systems are discussed. Object Oriented Requirements Analysis (OORA), Object-Oriented Requirements Specification (OORS), Object Oriented Analysis (OOA), Object Oriented Design (OOD), and Object Oriented Domain Analysis (OODA) are covered. Existing and upcoming object oriented Computer Aided Software Engineering (CASE) tools are examined and object oriented database design issues are discussed with analysis of specific systems currently in practice or under development.

COMP-723. Intrusion Detection

Credit 3 (3-0)

This course introduces the concepts, techniques, tools, and the state of the art in the area of network intrusion detection systems. Topics to be covered include: network and computer system security fundamentals, network security models and approaches, attack classification and analysis, intrusions detection techniques and tools (vulnerability scanners, network sniffer, system monitoring and logging, etc), firewall, as well as the tools and techniques for intrusion signature analysis, such as TCPdump and Snort, etc. The course will be a seminar-like, research-oriented class. Students are required to actively participate in the class presentations and discussions. Besides the textbooks, we will read and discuss many recent technical papers from current research in intrusion detection.

COMP-732. Advanced Software Tools

Credit 3 (3-0)

The software tools utilized in the high performance and massively parallel computing environments are indispensable to the practicing computer scientist. Message passing, profiling, languages, compilers, porting, system library usage, cache optimization, and in-lining are the topics of this course.

COMP-733. Parallel Computing Applications

Credit 3 (3-0)

Many problems in computing can be solved more efficiently on a parallel computer. The parallel computing paradigm is the main focus of this course. The applicability of Amdahl’s law, PRAM models, matrix by vector transforms, matrix by matrix graphics and visualization computations will be discussed.

COMP-740. Advanced Artificial Intelligence

Credit 3 (3-0)

This course is a further study of artificial intelligence principles, with a focus on knowledge based systems. The course examines planning, belief revision, control, and system evaluation and implementation. Advanced topics include automated theorem proving, learning and robotics, neural nets, and the adequacy of existing theoretical treatments.

COMP-741. Knowledge Representation and Acquisition

Credit 3 (3-0)

The representation formalisms used in artificial intelligence are explained, along with representation selection and implementation in common Artificial Intelligence languages and shells. Formalisms include first order logic and its extensions, semantic nets, frames and scripts, and KL-ONE-like languages. Knowledge acquisition is introduced as eliciting knowledge, interpreting elicited data within a conceptual framework, and the formalizing of conceptualizations prior to software implementation. Knowledge acquisition techniques such as protocol analysis, repertory grids, and laddering are examined.

COMP-742. Automated Reasoning

Credit 3 (3-0)

This course studies the computational aspects of logic via propositional and predicate calculi, as well as the theory underlying their automation through logic programming languages. Various forms of resolution and their soundness and completeness are examined along with unification and its properties. Proof procedures and their search characteristics, term rewriting, and techniques such as narrowing are researched as a means of theory

resolution. The relationship of formal specification techniques such as cut elimination, efficiency, and implementation issues are addressed. Prerequisite: COMP-645.

COMP-745. Computational Linguistics

Credit 3 (3-0)

A presentation of computational linguistics theory and practice. Advanced readings that emphasize theories of dialogue and research methodologies are examined. Technical writing for journals and conferences is stressed as a goal of research output. Prerequisite: COMP-645.

COMP-747. Computer Vision Methodologies

Credit 3 (3-0)

This course researches techniques for image understanding, both low-level and high-level image processing, mathematical morphology, neighborhood operators, labeling and segmentation. Vision methods covered include perspective transformation, motion, the consistent-labeling problem, matching, object models, and knowledge-based vision. Prerequisite: COMP-653.

COMP-749. Intelligent Robots

Credit 3 (3-0)

This course examines intelligent robot systems as inclusive of knowledge representations, path finders, inference systems of rules and logic, and image understanding and spatial reasoning systems. Problems of navigation, algorithm development, robot programming languages and multiple robot co-operation are explored.

COMP-750. Distributed Systems

Credit 3 (3-0)

This course examines the operating system concepts necessary for the design and effective use of networked computer systems. Such concepts include communication models and standards, remote procedure calls, name resolution, distributed file systems, security, mutual exclusion, and distributed databases. Students are required to construct an advanced implementation of distributed operating system facilities or a simulation of same.

COMP-753. Performance Modeling and Evaluation

Credit 3 (3-0)

Common techniques and current results in the performance evaluation of computer systems are studied in this course. Background material in probability theory, queuing theory, simulation, and discrete mathematics is reviewed so that a performance evaluation of resource management algorithms for operating systems and database management systems in parallel and distributed environments may be developed. Prerequisite: COMP-755.

COMP-755. Advanced Operating Systems

Credit 3 (3-0)

This course centers on operating systems for multi-processing environments: concurrent processes, mutual exclusion, job scheduling, memory, storage hierarchy, file systems, security, and distributed processing. Also discussed are virtual resource management strategies. A design project involving the construction of operating facilities is produced.

COMP-767. Computer Network Architecture

Credit 3 (3-0)

This is a course in the architecture of computer communication networks and the hardware and software required to implement the protocols that define the architecture. Basic communication theory, transmission technology, private and common carrier facilities, international standards, satellite communications, and local area networks are examined. Methods of performance analysis and communication network modeling are discussed.

COMP-770. Computer Organization and Programming for Scientific Computing Credit 3 (3-0)

Computer programming in the High Performance Computing environment is unlike that of the common workstation or desktop computing platform. Programming parallel computers with regard to data transfer (MPI), data storage and process execution are the main focus of this course. The architecture and organization of various parallel computing platforms are examined.

COMP-780. Semantics of Programming Languages

Credit 3 (3-0)

This course examines the formal treatment of the specification, meaning, and correctness of programs. Required mathematical results are examined, in areas such as universal algebra and category theory. Major course topics include the lambda calculus, type systems for programming languages, polymorphism, algebraic specification, rewrite systems, and semantic domains. The denotational semantics of programming languages, program logics, and program verification are discussed.

COMP-785. Advanced Design and Analysis of Algorithms

Credit 3 (3-0)

This course discusses the design and analysis of efficient algorithms and algorithmic paradigms. Applications include sorting, searching dynamic structures, graph algorithms, computationally hard problems, and NP completeness.

COMP-786. Multiagent Systems

Credit 3 (3-0)

This course primarily addresses multiagent systems, emphasizing collaboration and group attributes. Topics include planning for multiagent tasks and distributed planning, distributed problem solving, agent communication languages (involving speech acts), negotiation, ontologies and knowledge sharing, distributed rational decision making (involving techniques from economics), societal theories (from philosophy), and computational organization theory. Formalisms (including modal logics, process algebras, Petri nets, and Statecharts) are presented and applied to the specification and modeling of multiagent systems.

COMP-790. Special Topics in Computer Science

Credit 3 (3-0)

This course permits research in advanced topics pertinent to the student's program of study. Prerequisite: Permission of advisor.

COMP-792. Computer Science Masters Seminar

Credit 1 (1-0)

Discussions and reports of subjects in computer science and allied fields are presented.

COMP-793. Masters Supervised Teaching

Credit 3 (3-0)

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

COMP-796. Masters Project

Credit 3 (3-0)

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project and the deliverables, must be submitted for approval. This course is only available to project option students. Prerequisite: Permission of advisor.

COMP-797. Masters Thesis

Credit 3 (3-0)

Master of science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the master's thesis. This course is only available to thesis option students. Prerequisite: Permission of advisor.

COMP-999. Continuation Research

Credit 1 (1-0)

Continue incomplete thesis or project work.

Construction Management and Occupational Safety & Health

<http://www.ncat.edu/sot>

David A. Dillon, Chairperson

OBJECTIVES

The Department of Construction Management and Occupational Safety and Health (CM&OSH) prepares graduates to work in the fields of construction and safety and health. Most courses are structured with lecture and laboratory components which encourages both theoretical and practical applications. Graduates receive, depending upon the degree option, instruction in: estimating, project management, scheduling and planning, industrial hygiene, accident recognition, fundamentals of fire protection and many other related topics. Further, courses in business application, accounting and statistics are a part of the curriculum.

DEGREES OFFERED

Construction Management – Master of Science in Construction Management
Occupational Safety and Health – Master of Science in Occupational Safety and Health
Environmental and Occupational Safety and Health – Master of Science in Environmental and Occupational Safety & Health

PROGRAM DESCRIPTION

The School of Technology at North Carolina Agricultural and Technical State University offers a Master of Science in Industrial Technology (MSIT) degree. The program is designed with several options, three of which are in the Department of Construction Management and Occupational Safety and Health. These three aforementioned options are: Construction Management; Occupational Safety and Health and Environmental and Occupational Safety and Health.

These programs are designed to increase a student's understanding of industrial management challenges in an array of technical areas and to explore effective methods for dealing with technological evolutions and change.

ADMISSION REQUIREMENTS

The Master of Science in Industrial Technology, within the School of Technology, requires the GRE General Test as part of the admission process. No minimum score is required at this time. Please contact the Graduate School Office for more information.

DEPARTMENT REQUIREMENTS

The Master of Science in Industrial Technology degree program in Construction Management has a thesis option which requires 12 credit hours of CORE courses, 6 credit hours of Management course; 9 credit hours of thesis option. The non-thesis option requires the same number of credit hours in CORE courses, Management courses, and Technical courses; however, 9 credit hours of Non-Thesis option are substituted.

PROGRAM CURRICULA

CORE COURSES

MSIT 610	Problem Solving in Industrial Technology
MSIT 779	Statistical & Research Methods in Industrial Technology I
MSIT 700	Concepts of Technological Innovations
MSIT 740	Leadership Development Seminar

MANAGEMENT COURSES

CM 692	Project Management
CM 710	Advanced Construction Management and Organization

CM 720	Construction Contract Administration
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TECHNICAL COURSES

CM 603	Environmental Issues in Construction Technology
CM 617	Independent Study I
CM 618	Independent Study II
CM 650	Construction Contracts and Law
CM 675	Advanced Construction Planning and Scheduling
CM 678	Real Estate and Land Development
CM 685	Experiential Graduate Internship
CM 686	Special Problems in Construction Management
CM 715	Productivity and Methods Improvement in Construction
CM 750	Research Methods in Construction
CM 780	Emerging Trends in CM of International Projects

THESIS OPTION

MSIT 780	Statistical and Research Methods in Industrial Technology II
MSIT 791	Thesis I
MSIT 792	Thesis II

NON-THESIS OPTION

MSIT 750	Internship I
MSIT 751	Internship II
MSIT 789	Master's Project

The Master of Science in Industrial Technology Degree Program in Occupational Safety and Health requires the same course courses and thesis and non-thesis options as for the Construction Management degree program; however, the following management and technical electives are used in this degree program:

MANAGEMENT COURSES

OSH 614	Industrial Relations
OSH 708	Occupational Safety and Health Management
OSH 709	Current Issues in Occupational Health and Safety
OSH 710	Legal Issues in Occupational Health & Safety Practice

TECHNICAL COURSES

OSH 600	Occupational Toxicology I
OSH 613	Industrial Hygiene Ventilation
OSH 630	Industrial Safety
OSH 632	Design of Engineering Hazard Controls
OSH 637	Machine and welding Safety
OSH 642	Electrical Safety
OSH 672	Systems Safety and Other Analytical Methods
OSH 678	Experiential Education I
OSH 679	Experiential Education II
OSH 700	Special Problems in Occupational Health and Safety
OSH 704	Occupational Epidemiology
OSH 706	Noise Control
OSH 712	Education and Training Methods for Safety
OSH 731	Toxicology for the Industrial Hygienist
OSH 751	Industrial Ventilation

The Environmental and Occupational Safety and Health Degree Program is an interdisciplinary concentration which is designed to prepare individuals with a background in environmental safety and health. Graduates will become associated with the scientific, managerial, and supervisory activities in industry, as well as other business sectors. Individuals will develop both technical skills as well as environmental safety and health management skills for industry applications and entrepreneurship.

The EOSH concentration (42 credit hours—all coursework) is comprised of a broad range of topics including: environmental health, environmental science, environmental education, solid waste management, highway operations safety, epidemiology, air pollution, electronics and computer technology, and environmental toxicology.

This program requires the same CORE courses as those of the Construction Management and Occupational Safety and Health programs; however, the remaining portion of the program is as follows:

MANAGEMENT ELECTIVES

AGED 601	Environmental Education
BIO 700 (or)	Environmental Science
ECT 634	Electronic Instrumentation for Remote Sensing Applications

TECHNICAL ELECTIVES

ANSC 624	Environmental Toxicology
CIEN 616	Solid Waste Management
CIEN 618	Air Pollution Control
CIEN 710	Hazardous Waste Management
CIEN 756	Highway Operations Safety
OSH 706	Noise Control
OSH 704	Occupational Epidemiology
OSH 710	Legal Issues in Occupational Safety & Health

The CM and OSH programs require a minimum of 36 semester hours and the EOSH program requires a minimum of 42 semester hours. All programs require a student to pass a written comprehensive examination. In addition, at least fifty percent (50%) of the courses counted toward the Master of Science degree must be numbered 700 and above, and students must maintain and complete the program with an overall GPA of 3.0 or better on a scale of 4.0. Up to six semester hours of graduate work may be transferred from another university, provided it is not a part of any prior undergraduate degree program. Transfer credit must be at a level comparable to 600 or 700 level courses at North Carolina Agricultural and Technical State University. The GRE exam must be taken prior to unconditional acceptance into the program. Further, students without sufficient undergraduate preparation may be required to take additional undergraduate course work

COURSE DESCRIPTIONS IN CONSTRUCTION MANAGEMENT AND OCCUPATIONAL SAFETY AND HEALTH (Undergraduate/Graduate)

Construction Management

CM 603. Environmental Technology for Construction

Credit 3(3-0)

The environmental issues facing the construction industry are studied. Issues include site management, water supply, storm water management, sewage disposal, solid and hazardous waste management, air and noise pollution. Emphasis will be placed on local, state and federal standards that impact upon construction projects during each phase from design to completion. Prerequisite: Senior standing.

- CM 617. Independent Studies I** **Credit 3(3-0)**
Study is arranged on a special construction topic of interest to the student and faculty member, who will act as advisor. Consent of Instructor Required.
- CM 618. Independent Studies II** **Credit 3(3-0)**
Study is arranged on a special construction topic of interest to the student and faculty member, who will act as advisor. Consent of Instructor Required.
- CM 650. Construction Contracts and Law** **Credit 3(3-0)**
This course deals with contracts and the law in regard to construction company formation, methods of advertising, bidding process, contract formation and awards. Special emphasis is placed on law pertaining to the construction industry. Extensive case studies are reviewed. Prerequisite: CM 594 or equivalent.
- CM 675. Advanced Construction Planning and Scheduling** **Credit 3(2-3)**
The planning, scheduling, and organizing of construction projects to control time, costs and other resources are studied. Emphasis is on advanced preparation, analysis, and control of network schedules, using computers and a variety of software. Prerequisite: CM 594 or equivalent.
- CM 678. Real Estate and Land Development** **Credit 3(3-0)**
This course will provide an overview of land planning and development. A step-by-step description of the land development process and the relationship of each of the steps to the overall process will be the main focus. Topics to be covered include regulatory and financial elements as they relate to the development process such as zoning, floor area ratios, development bonus for amenities, zoning variances, building permits and inspections, real estate taxes, development districts, historic preservation, market feasibility studies, financial analysis, management, and leasing processes. Prerequisite: CM 216 or equivalent.
- CM 685. Graduate Internship I** **Credit 3(3-0)**
This course is an internship experience in construction-related industries. A special project is required. Consent of Graduate Advisor.
- CM 686. Graduate Internship II** **Credit 3(3-0)**
This course is an internship experience in construction-related industries. A special project is required. Consent of Graduate Advisor.
- CM 690. Special Problems in Construction Management** **Credit 3(3-0)**
Study is arranged on a special construction management topic of interest to students and faculty member who will act as advisor. Topics may be analytical and/or experimental and require independent study with a construction industry partner. Consent of Instructor and Construction Industry Partner.
- CM 692. Project Management** **Credit 3 (3-0)**
A comprehensive study of project management functions at the managerial level. Special sis on project organization, planning, scheduling, resource allocation, budgeting and control. Pre-requisite: Graduate standing or permission of instructor.
- CM 710. Advanced Construction Practices and Organization** **Credit 3 (3-0)**
Advanced construction practices are developed at the project level. Construction company organization, project preplanning, value engineering concepts, cost control and application of construction control techniques to construction project development are studied as they relate to construction. Pre-requisite: CM 598; Graduate standing.
- CM 715. Productivity and Methods Improvement in Construction** **Credit 3 (3-0)**
Methods and techniques of analyzing construction work to improve productivity are studied. Total quality management, worker motivation, productivity ratings, crew balancing and work measurement are discussed and developed as models for change in the construction management process. Prerequisites: CM 710; Graduate Standing.
- CM 720. Construction Contract Administration** **Credit 3 (3-0)**

This course will focus on contracts for design and construction of structures. Legal aspects, labor-management relationships, estimating and bidding strategies are incorporated into a study of administrative procedures. Computer applications in contract administration are reviewed. Pre-requisite: Graduate standing.

CM 750. Research Methods in Construction

Credit 3 (3-0)

Fundamentals of construction research methods, techniques, research design, data collection and analysis with relevant computer applications are incorporated into the course. Pre-requisite: ECON 305.

CM 780. Emerging Trends in Construction Management of International Projects

Credit 3 (3-0)

Project delivery systems, remote sensing, three-dimensional documentation, site logistics, construction materials and methods development, international law, cultural and demographic differences are applied to the construction process. Study will emphasize the international aspect of the industry.

Occupational Safety and Health

OSH 600. Occupational Toxicology I

Credit 3 (3-0)

This course is a basic survey of the principles of toxicology. Emphasis will be placed on the effects of common industrial toxicants; absorption, distribution, secretion and bio-transformation of toxicants; and toxicological assay methods. Mechanisms of action, testing, risk assessment, carcinogenesis, oncogenes, receptors, toxicological evaluation, and host/environmental interactions will be discussed.

OSH 613. Industrial Hygiene Ventilation

Credit 3 (3-0)

This course will acquaint health and safety professionals with the principles of local and general ventilation systems. Topics covered include: basic terms and formula, hoods, design considerations, air cleaners, fans, exhaust system performance, dilution ventilation, comfort ventilation, make-up air requirements, indoor air quality standards and HVAC systems.

OSH 614. Industrial Relations

Credit 3 (3-0)

This course is an overview of legislations and methods pertinent to the practice of occupational safety and health in the human resource environment. Emphasis is placed on total quality management, anti-discrimination legislation, wage and hour law, workers' compensation, training for safety, behavioral aspects of safety, and the process of health and safety inspections of the Occupational Safety and Health Administration.

OSH 617. Independent Study I

Credit 3 (3-0)

Students will study a special OSH topic of interest to the student and an OSH faculty member who will supervise the study.

OSH 700. Special Problems in Occupational Safety & Health

Credit 3 (3-0)

This course provides an opportunity to study special areas in the discipline. Course content will be determined by the Department and the instructor with a complete syllabus each time the course is offered.

OSH 704. Occupational Epidemiology

Credit 3 (3-0)

The main focus of this course is on the fundamentals of occupational epidemiology, epidemiological methods used in both chronic and infectious occupational disease epidemiology, application of methods to safety and health research and practice will be stressed. Epidemiologic topics will also be related to subjects in occupational safety and health management.

OSH 706. Noise Control

Credit 3 (3-0)

This course will cover the following topics: properties of sound, occupation damage-risk criteria, noise surveys and measuring equipment, noise control programs, and engineering controls.

OSH 708. Occupational Safety & Health Management I

Credit 3 (3-0)

This course is an overview of management tools, such as goal setting, planning, organizing, etc. to the OSH program so as to enhance the safety and health of employees in the workplace and compliance with the applicable local, state and national standards. An emphasis is placed on the development, implementation and evaluation of written OSH programs.

OSH 709. Occupational Safety & Health Management II

Credit 3 (3-0)

A study of the principles of the development and management of materials, techniques, and procedures used in the implementation of occupational safety and health programs and their application in a variety of occupational settings. Examined will be the management techniques, governmental relations, and safety and health programs

developed for industry. The course will focus on the history of the safety and health movement; government regulations; safety and health program organization; hazard information and analysis process; and implementation of an occupational safety and health program.

OSH 710. Legal Issues in OSH Practice

Credit 3 (3-0)

This course is designed to review and analyze occupational safety and health and environmental regulations. Significant court cases and litigation procedures will be presented to show the student how regulatory compliance and interpretations evolve.

OSH 711. Current Issues in Occupational Safety and Health

Credit 3 (3-0)

This course explores contemporary issues related to the field of Occupational Safety and Health. Therefore the content for this course will vary depending upon occurrences within our society and the world as they relate to this field of study.

OSH 712. Education and Training Methods of Safety

Credit 3 (3-0)

Lectures with emphasis on education/training for the control or prevention of occupational injuries or illnesses. Education/training methods, materials and available courses are stressed. The student is expected to determine the need for education training, design a program for a specific control effort and establish criteria for evaluation of the program.

OSH 731. Toxicology for the Industrial Hygienist

Credit 3(3-0)

This course is a basic survey of the principles of toxicology. Emphasis will be placed on the effects of common industrial toxicants; absorption, distribution, secretion, and biotransformation of toxicants; and toxicological essay methods. Prerequisite: OSH 416 or approval of instructor.

OSH 751. Industrial Ventilation

Credit 3(2-2)

This course is an introduction to the design of local exhaust ventilation systems for the control of airborne contaminants. An emphasis will be placed on the velocity pressure method of predicting system performance, and minimization of total installation and operational costs. Prerequisite: OSH 416 or approval of instructor.

Curriculum and Instruction

Dorothy D. Leflore, Chairperson
201 Hodgin Hall
(336) 334-7848

OBJECTIVES

The Department of Curriculum and Instruction provides the professional studies component for the preparation of effective teachers and school personnel at the bachelor's degree and master's degree levels. The department cooperates with the various academic departments of the University for teacher education preparation. The department offers graduate degrees in the areas of elementary education and instructional technology. In addition, Licensure only is available in elementary education and special education.

PROFESSIONAL STUDIES COMPONENT

The professional studies component of the Teacher Education Program is designed to provide for the development of those competencies essential to the professional role of a teacher or special service personnel. At the graduate level, approximately 20 to 40 percent of the graduate program is comprised of professional studies. Candidates for the degree in teacher education must complete a minimum of 15 semester hours in professional studies.

ACCREDITATION

All Teacher Education Programs are accredited by the National Council for Accreditation of Teacher Education (NCATE) and approved by the North Carolina Department of Public Instruction.

CAREER OPPORTUNITIES

In addition to preparing teachers for elementary education (K-6) and special education, a degree or licensure in these fields also provides for career opportunities in other areas related to the education of children and youth.

The instructional technology program has four program concentration areas that prepare students for different career paths. Students who do not hold a teaching license can prepare for careers in Instructional Technology, in Business and Industry settings. Individuals who currently hold a North Carolina "A" teaching license may pursue coursework that prepares them for licensure as school media coordinators (076 licensure), instructional technologists-computers (077 licensure), or instructional technologists-telecommunications (074 licensure).

DEGREES OFFERED

Master of Arts Education - Elementary Education
Master of Science - Instructional Technology

LICENSURE PROGRAMS OFFERED

Elementary Education
Special Education

GENERAL PROGRAM REQUIREMENTS

Degree seeking students must follow the general admission requirements for graduate studies and meet other requirements as stated in "Admission and Other Information".

THE ELEMENTARY EDUCATION GRADUATE PROGRAM

The Elementary Education Graduate Program provides advanced studies in the field of elementary education commensurate with INTASC, NCATE, SDPI, and National Board Certification Standards. The program provides experiences in research, technology, methodology, diversity, and learning theory. The program also requires a product of learning which includes a final comprehensive examination, a basic portfolio, and either a research project or a comprehensive portfolio that meets the requirements for submission for National Board

Certification.

Licensure Only Students

Candidates who are admitted to graduate studies as licensure only students cannot be admitted to the Graduate Program until Class A licensure in elementary education is obtained.

After a student obtains a Class A Certification, application for admission to the graduate program may be pursued.

Admission Criteria

Other criteria for admission are GRE or MAT scores, and an undergraduate GPA of 2.5 or better. It is the responsibility of the candidate to meet these requirements as well as any other requirements of the School of Graduate Studies.

Course Requirements

The Curriculum Guide outlines the sequence of required courses and the benchmarks. A copy of this guide will be kept in the student's folder in the advisor's office to be updated at each advising conference. The candidate prior to registration must arrange advising conferences for the next semester. Before a candidate can register for classes in Phase 2 of the

Elementary Education Graduate Program, all the requirements of Benchmark 1 must have been met. Before a candidate can register for classes in Phase 3 of the Elementary Education Graduate Program, all the requirements of Benchmark 2 must have been met. The Elementary Education Graduate Program requires a 3.0 GPA for graduation.

Products of Learning

All students will produce products of learning that include a passing grade on a comprehensive examination at Benchmark 1 upon completion of Phase 1 of the Elementary Education Graduate Program, a basic portfolio that meets the requirements of the North Carolina State Department of Public Instruction's performance-based licensure, and completion of the Capstone Experience. The Capstone Experience requires a passing grade on the final comprehensive examination and either a research project or a comprehensive portfolio that meets the requirements for submission for National Board Certification in Elementary Education.

PHASE 1: DEVELOPING PERSPECTIVES. (Complete before beginning Phase 2.)

Requirements (15 hours)

CUIN 711:	Research and Inquiry
CUIN 619:	Learning Theories
CUIN 728:	Integrating Technology into the K-12 Curriculum
CUIN 729:	Advanced Methods and Internship

Documentation of Approvals: (1) Planning contract; (2) Initial plan for Master's Research Project or Comprehensive Portfolio approved; (3) Core Comprehensive Examination passed.

PHASE 2: CONTENT AND PEDAGOGY. (Complete before beginning Phase 3.)

Requirements (24 hours)

CUIN 720:	Curriculum Development
ELED 750:	Teaching and Learning in a Multicultural Classroom
ELED 751:	Advanced Communications
ELED 752:	Advanced Science
ELED 754:	Advanced Mathematics
ELED 753:	Advanced Social Studies
ELED 755:	Teachers as Educational Leaders
ELED 756:	Assessment and Evaluation

Documentation of Approvals: (1) Master's Research Project Proposal or Four Entries in Comprehensive Portfolio

PHASE 3: CAPSTONE EXPERIENCE

Requirements (1 hour)

CUIN 999:	Capstone Experience
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Documentation of Approvals: (1) Comprehensive Examination passed, and (2) Completion of Research Project or Completion of Comprehensive Portfolio

INSTRUCTIONAL TECHNOLOGY

The Master of Science degree program in Instructional Technology at North Carolina A&T State University is housed in the School of Education's Department of Curriculum and Instruction. This program helps students in both business and education to acquire skills and knowledge to work with instructional design and delivery at any level. A variety of course work is offered to address different professional goals and needs within the field of Instructional Technology. All instructional technology program concentrations require a minimum of a 3.0 GPA for graduation.

Specifically, the course work includes not only the use of a variety of media but the science and art of instructional planning, and the delivery of instruction in a variety of settings.

Students will gain both theoretical and practical knowledge in the field of Instructional Technology. There are four Program Concentrations: business and industry and three add-on licensure areas.

Accreditation: All programs involving licensure are accredited by the National Council for Accreditation of Teacher Education (NCATE) and the North Carolina Department of Public Instruction. See student resources.

On-line Program

North Carolina A&T State University offers the Business and Industry track of the Instructional Technology Master's program via the World Wide Web. Please consult the Center for Distance Learning Website (www.distance.ncat.edu) for further information.

Instructional Technology Specialist Telecommunications (074) Program Concentration

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
CUIN 742: Integrating Technology Across the Curriculum
CUIN 729: Diversity
CUIN 721: Advanced Methods and Internship
Benchmark #1 - Core Comprehensive Exam

Required Content and Pedagogy (21 hours)

CUIN 743: Foundations of Instructional Technology
CUIN 616: Visual Media
CUIN 762: Advanced Internet Uses in Education
CUIN 767: Computer Lab Supervision and Management
CUIN 766: Distance Education
CUIN 763: Multimedia Development and Evaluation
CUIN 719: Internship in Instructional Technology

Elective Courses - None

Benchmark #2 - Portfolio
Benchmark #3 - Capstone: Thesis or Special Project

Media Coordinator Program Concentration (076)

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
CUIN 742: Instructional Design
CUIN 728: Integrating Technology Across the Curriculum
CUIN 729: Diversity
CUIN 721: Advanced Methods and Internship
Benchmark #1: Core Comprehensive Exam

Required Content and Pedagogy (18 hours)

CUIN 750: Cataloging and Media Material
CUIN 613: Developmental Media for Children OR
CUIN 614: Book Selection and Related Materials for Young People
CUIN 616: Visual Media
CUIN 716: Media Center Management
CUIN 719: Internship in Instructional Technology

Elective Courses (9 hours)

Benchmark #2: Portfolio and Praxis Examination (Library Media Specialist)

Benchmark #3: Capstone: Thesis or Special Project

Instructional Technology Specialist Computer Program Concentration (077)

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
CUIN 742: Instructional Design
CUIN 728: Integrating Technology Across the Curriculum
CUIN 729: Diversity
CUIN 721: Advanced Methods and Internship
Benchmark #1: Core Comprehensive Exam

Required Content and Pedagogy (18 hours)

CUIN 743: Foundations of Instructional Technology
CUIN 760: Programming in BASIC or
CUIN 761: Programming in LOGO
CUIN 762: Advanced Internet Uses in Education
CUIN 763: Multimedia Development and Evaluation
CUIN 767: Computer Lab Supervision and Management
CUIN 719: Internship in Instructional Technology

Elective Courses (3 hours)

Benchmark #2: Portfolio

Benchmark #3: Capstone - Thesis or Special Project

Business and Industry Program Concentration

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
CUIN 742: Instructional Design
CUIN 743: Foundations of Instructional Technology
CUIN 741: Instructional Technology Services for Business and Industry
ADED 708: Methods in Adult Education
Benchmark #1: Core Comprehensive Exam

Required Content and Pedagogy (12 hours)

CUIN 762: Advanced Internet Uses in Education
CUIN 763: Multimedia Development and Evaluation
TECH 670: Introduction to Workplace Training and Development
CUIN 719: Internship in Instructional Technology

Elective Courses (9 hours)

(You may take approved courses from ADED, TECH or GCT).

Benchmark #2: Portfolio

Benchmark #3: Capstone: Thesis or Special Project

CURRICULUM AND INSTRUCTION Advanced Undergraduate and Graduate

Six-Hundred (600) level courses are considered upper level undergraduate and lower level graduate courses. These courses in the department are designed for post-baccalaureate students pursuing licensure.

Students admitted to a graduate program will not be allowed to take more than six hours of 600 level courses without the approval of his/her advisor.

CUIN-600. Cataloging of Media Materials

Credit 3 (3-0)

This course offers a survey of various media classifications, storage and retrieval models as applied to information centers and their operation. Students will be taught to catalog media by using both traditional and technological methods. (F, S, S)

CUIN-611. Utilization of Education Media

Credit 3 (2-2)

Applies basic concepts to problems in teaching and learning with school and adult audiences. Relates philosophical and psychological bases of communications to teaching. Discusses the role of communications in problem solving, attitude formation, and teaching, methods of selecting and using educational media materials effectively in teaching. It provides experience in operating equipment, basic techniques in media preparation and practice in planning and presenting a session. (F, S, S)

CUIN-613. Developmental Media for Children **Credit 3 (3-0)**

This course will entail a study of children's literature with emphasis on aids and criteria for selection of books and other materials for preschool through late childhood ages, story telling, and an investigation of reading interests. (F, S, S)

CUIN-614. Book Selection and Related Materials for Young People **Credit 3 (3-0)**

A consideration of literature, reading interests, and non-book materials for young people. (F, S, S)

CUIN-616. Visual Media **Credit 3 (3-0)**

This course provides students with general visual design criteria and the application of those criteria to a variety of visual media forms. Students will create and evaluate a variety of visual media, such as non-projected forms, projected forms, video, and computer visuals. New forms of visuals may be included as they are developed. Prerequisite: CUIN 611. (F, S, S)

CUIN-617. Computers in Education **Credit 3 (2-2)**

The student will be introduced to the various uses and functions of the computer in educational settings. The integration of the computer as a tool for instructor and student use; and its use as a tutor for student use in a variety of formats will be addressed. A basic introduction to the Internet and the World Wide Web will also be provided. Students will also explore different hardware and software configurations. This is not a course for introducing computer usage. (F, S, S)

CUIN-619. Learning Theories **Credit 3 (3-0)**

This course examines behavioral, cognitive, and constructivist learning theory families and how they impact instructional methods and technology. The course will include writing instructional units based upon a variety of theoretical approaches. (F, S, S)

CUIN-620. Foundations in Reading **Credit 3 (3-0)**

Basic reading course which considers the broad field of reading - its goal and nature; factors affecting its growth; sequential development of skills, attitudes and interests; types of reading approaches; organization and materials in teaching the fundamentals of reading. (F, S, S)

CUIN-621. Word Recognition/Identification Skills **Credit 3 (3-0)**

This course explores phonic (letter-sound correspondence), syntactic (grammar), semantic (meaning), morphemic (structure) and visual word identification techniques for word recognition in developmental, corrective and remedial reading programs. Methods of teaching and materials for introducing and reinforcing the skills are included. (F, S, S)

CUIN-622. Teaching Reading Through the Primary Years **Credit 3 (3-0)**

Methods, materials, and techniques used in reading instructions of pre-school through grade three. An examination of learning, the teaching of reading, and curriculum experiences and procedures for developing reading skills. (F, S, S)

CUIN-623. Methods and Materials in Teaching Reading in the Elementary School **Credit 3 (3-0)**

The application of principles of learning and child development to the teaching of reading and the related language arts. Methods and approaches to the teaching of reading in the elementary school; including phonics, developmental measures, informal testing procedures, and the construction and utilization of instructional materials. (F, S, S)

CUIN-624. Teaching Reading in the Secondary School **Credit 3 (3-0)**

Nature of a developmental reading program, initiating and organizing a high school reading program, the reading curriculum, including reading in the content subjects, critical reading,

procedures and techniques, and corrective and remedial aspects. (F, S, S)

CUIN-625. Theory of American Public Education **Credit 3 (3-0)**

An examination of the philosophical resources, objectives, historical influences, social organization, administration, support, and control of public education in the United States. (F, S, S)

CUIN-627. The Afro-American Experience in American Education **Credit 3 (3-0)**

Lectures, discussions, and research on the Afro-American in American education, including the struggle for literacy, contributions of Afro-Americans to theory, philosophy, and practice of education in the public schools, private and higher education traces the development of school desegregation, its problems and plans. (F, S, S)

CUIN-628. Seminar and Practicum in Urban Education **Credit 3 (1-4)**

A synthesis of practical experiences, ideas and issues pertinent to more effective teaching in urban areas. (F, S, S)

CUIN-629. Classroom Diagnosis in Reading Instruction **Credit 3 (3-0)**

Methods, techniques and materials used in the diagnosis of reading problems in the kindergarten-primary area through to intermediate level. Attention is placed upon the pupil and the interpretation of physiological, psychological, sociological, and educational factors affecting learning to read. Opportunity is provided for identification, analysis, interpretation of, and strategies for fulfilling the reading needs of all pupils. (F, S, S)

CUIN-630. Reading Practicum **Credit 3 (3-0)**

Application of methods, materials and professional practices relevant to teaching pupils. Provisions for participation in and teaching of reading. Designed to coordinate the student's background in reading, diagnosis, learning and materials. Supervised student teaching. Prerequisite: 12 credit hours in reading. (F, S, S)

CUIN-631. Reading for the Atypical Learner **Credit 3 (3-0)**

Attention to the gifted child, the able retarded, the slow learner, the disadvantaged, and the linguistically different child. Special interest groups will be formed for investigation reports. (F, S, S)

CUIN-632. Basic Technology Literacy for K-12 Educators **Credit 3 (3-0)**

This course provides instruction in basic computer literacy skills and classroom integration for K-12 educators. The instruction is designed to meet the North Carolina Department of Public Instruction's requirements for basic level computer competencies for public school teachers. Topics include: word processing, spreadsheet usage, database design and management, teacher utilities, and fundamentals of modern computing. (F, S, S)

CUIN-681. Issues in Education **Credit 3 (3-0)**

A critical review of the background and functions of the school as a social institution. (F, S, S)

Graduate Students Only

CUIN-700. Introduction to Graduate Study **Credit 2 (2-0)**

Methods of research, interpretation of printed research data, and use of bibliographical tools. (F, S, S)

CUIN-701. Philosophy of Education **Credit 3 (3-0)**

A critical study of and a philosophic approach to educational problems. The nature and aims of education in a democratic society, relation of the individual to society, interests and disciplines, play and work, freedom and control, subject matter and method. (F, S, S)

CUIN-709. Administration and Supervision **Credit 3 (3-0)**

This comprehensive course in organization and administration of schools, grades K-12, will focus primary emphasis on the following areas: (1) formal and informal organizational structure, concepts and practices; (2) the management processes; (3) the administrative functions, with particular reference to personnel, program, and fiscal management; and (4) leadership styles and the leadership role, with special attention to planning, decision-making, and conflict-resolution. Prerequisite: CUIN-704. (F, S, S)

CUIN-710. Educational Statistics **Credit 3 (3-0)**
The essential vocabulary, concepts, and techniques of descriptive statistics as applied to problems in education and psychology. (F, S, S)

CUIN-711. Research and Inquiry **Credit 3 (3-0)**
This course is designed to teach students to be able to locate, read, understand, critique, and use the results of research to become more effective professionals and make sound educational decisions. Students will develop an understanding of the researcher's methodologies, the procedures, and results. Students will analyze and evaluate research, judge the usefulness of the findings for educational practice, and plan research to improve educational practice. (F, S, S)

CUIN-716. Media Center Management **Credit 3 (3-0)**
In this course students will be expected to explore different methods for organizing and operating media centers. Students will be expected to create plans for media center organization and operation, including budget planning. In addition, students will create plans for both student activities and faculty in-service as related to media center use. (F, S, S)

CUIN-719. Internship in Instructional Technology **Credit 3 (1-4)**
This is a professional laboratory designed to provide the student with on-the-job training and direct experiences relating to his/her needs. Each student will be placed according to the professional track he/she has chosen within the program. Students will have an opportunity to develop research or special projects in an area related to practical experience. (F, S, S)

CUIN-720. Curriculum Development **Credit 3 (3-0)**
This course will focus on basic concepts in curriculum development in K-12 schools.
Prerequisites: Completion of Phase I of the M.S. Degree in Elementary Education or permission of the instructor. (F, S, S)

CUIN-721. Advanced Methods and Internship **Credit 3 (3-0)**
This course will focus on using an understanding of child development, diversity issues and motivational strategies to plan interdisciplinary units of instruction and assessment. Candidates will create learning experiences and design a variety of modes of assessment and implement these plans. Internship is required. Prerequisites: Admission to the School of Graduate Studies. (F, S, S)

CUIN-722. Curriculum in the Secondary School **Credit 3 (3-0)**
Curriculum development, functions of the secondary school, types of curricula; emphasis on trends, issues, and innovations. (F, S, S)

CUIN-723. Principles of Teaching **Credit 3 (3-0)**
A study of the status of teaching as a profession in the United States; teacher obligations, responsibilities and opportunities for leadership in the classroom and community with special emphasis on principles of and procedures in teaching. (F, S, S)

CUIN-724. Problems and Trends in Teaching Science **Credit 3 (3-0)**
Attention to major problems of the high school teacher of science. Lesson plans, assignments, tests, etc., are constructed and administered by each student in class. Audiovisual materials, demonstration and laboratory techniques are carried out. (F, S, S)

CUIN-725. Problems and Trends in Teaching Social Sciences **Credit 3 (3-0)**
A survey of major problems in the broad field of social studies and consideration of improved ways in presentation and class economy, including lesson plans, assignments, audiovisual materials, and other means of facilitating learning. (F, S, S)

CUIN-726. Reading in the Content Areas **Credit 3 (3-0)**
Attention is given to reading problems and procedures and materials for improving reading in social studies, science, English, mathematics, a foreign language, home economics, and other fields. (F, S, S)

CUIN-727. Workshop in Methods of Teaching Modern Mathematics for Junior and Senior High School Teachers **Credit 3 (3-0)**

Model lesson plans, use of educational media, geometric and trigonometric devices, Truth Tables, and intuitive and formal logic in the teaching of modern mathematics in the junior and senior high school. (F, S, S)

CUIN-728. Integrating Technology into the K-12 Curriculum **Credit 3 (3-0)**

This course is designed to introduce teachers to the current and emerging technologies, which can be incorporated into the K-12 curriculum. Prerequisite: Pass a Computer Competency Exam or CUIN 617. (F, S, S)

CUIN-729. Diversity Issues in K-12 Schools **Credit 3 (3-0)**

This course is designed to examine issues of diversity including economic, gender, ethnic, cultural, political, physical and cognitive diversities, and how they impact classroom practices. (F, S, S)

CUIN-730. Problems in the Improvement of Reading **Credit 3 (3-0)**

A study of current problems, issues, trends, and approaches in the teaching of reading including investigations of underlying principles of reading improvement; coverage of appraisal techniques, materials and procedures, innovative and corrective measures; and application of research data and literature will be carried out. Prerequisite: A previous graduate course in reading. (F, S, S)

CUIN-731. Advanced Diagnosis in Reading Instruction **Credit 3 (3-0)**

The diagnosis and treatment of reading difficulties. Study and interpretation of selected tests useful in understanding and analyzing physiological, psychological, sociological and educational factors related to reading difficulties. Case studies and group diagnosis. (F, S, S)

CUIN-732. Organization and Administration of Reading Program **Credit 3 (3-0)**

Administrative acts requisite to the creation and guidance of a well-balanced, school-wide reading program. The course is for all school personnel who are in a position to make administrative decisions regarding the school reading program. (F, S, S)

CUIN-733. Advanced Practicum in Reading **Credit 3 (3-0)**

Actual experiences with youth and teachers in professional activities. (F, S, S)

CUIN-734. Seminar and Research in Reading **Credit 3 (3-0)**

Evaluation of recent research concerning findings, approaches, innovations and organization of reading instruction. Selected topics for reports and research projects. Independent study of selected topics of experimentation. Prerequisite: 24 semester credit hours in graduate courses. (F, S, S)

CUIN-742. Instructional Design **Credit 3 (3-0)**

The course will address the design, systematic development, implementation, modification, and ultimate evaluation of instructional programs. This will be inclusive of a survey of current research, objectives, outcomes, analysis of concepts, design of instructional sequences, and assessment of student performance. Each student will develop and assess at least one instructional program. (F, S, S)

CUIN-743. Foundations of Instructional Technology **Credit 3 (3-0)**

This course provides an overview of the Instructional Technology field. Students will be introduced to some of the significant issues, areas, and practices in instructional technology. The history, current trends, and issues in instructional technology and their implications for education and training will be discussed during the course. This course also examines the instructional applications of microcomputers and telecommunications in classroom settings. Students will be informed of job opportunities, professional associations, and literature of the profession. (F, S, S)

CUIN-744. Program Evaluation **Credit 3 (3-0)**

This course will provide students with the basic information needed to evaluate educational

programs and make recommendations for program improvement. Prerequisite: CUIIN 742.
(F, S, S)

CUIIN-745. Instructional Technology Services for Business and Industry **Credit 3 (3-0)**

This course introduces students to the impact of technology within business and industry and how learning in that environment warrants instruction that differs from that of traditional education. Students will have the opportunity to (a) investigate various learning and presentation needs of business and industry clients; and (b) apply different delivery methods and techniques, and technological applications to specific audiences in that environment. (F, S, S)

CUIIN-746. Social Foundations of Instructional Technology **Credit 3 (3-0)**

This course will provide students with an opportunity to explore the philosophical, personal, and social issues underlying the universal acceptance of the technological revolution, with special emphasis on technology in education and in K-12 schools. (F, S, S)

CUIIN-747. Independent Study in Instructional Technology Variable **Credit (1-3)**

Students will pursue individual project(s) and topic(s) of choice with the approval of the instructor. (F, S, S)

CUIIN-748. Special Topics in Instructional Technology Variable **Credit (1-3)**

This course will permit the investigation and study of developing areas/topics of concern in the field of instructional technology. (F, S, S)

ELED-751. Advanced Communication Skills **Credit 3 (3-0)**

This course will focus on approaches for teaching communications skills/language arts and children's literature in elementary school. Prerequisites: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

ELED-752. Advanced Science **Credit 3 (3-0)**

This course will focus on approaches for teaching science in elementary school. Prerequisites: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

ELED-754. Advanced Mathematics **Credit 3 (3-0)**

This course will focus on approaches for teaching mathematics in elementary school. Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

CUIIN-760. Programming in BASIC **Credit 3 (2-2)**

This course will provide students with an opportunity to learn program logic and structured programming for BASIC. Emphasis will be on the use of programming in the K-12 environment. Prerequisite: CUIIN 617 or equivalent experience. (F, S, S)

CUIIN-761. Programming in LOGO **Credit 3 (2-2)**

This course provides students with the opportunity to programming and logic and structured programming for LOGO. Emphasis will be on the use of programming in the K-12 environment. (F, S, S)

CUIIN-762. Advanced Internet Uses in Education **Credit 3 (2-2)**

This course explores use of the Internet for the purpose of enhancing instructional activities. Students will investigate a variety of resources on the Internet, which can be used for instructional purposes. Students will explore the World Wide Web and develop Web pages. Prerequisite: CUIIN 617 or equivalent. (F, S, S)

CUIIN-763. Multimedia Development and Evaluation **Credit 3 (2-2)**

This course offers experiences in the evaluation and development of multimedia instructional presentations using computer-based multimedia capabilities. Theories and research in multimedia development will be discussed. Prerequisite: CUIIN 617 or equivalent. (F, S, S)

CUIIN-764. Educational Software Evaluation and Design **Credit 3 (2-2)**

This course will provide students with the opportunity to apply instructional design techniques

and learning theories to the evaluation and development of educational software. During the course students will learn storyboarding and use it as a means to create computer-based software. Some limited experiences with authoring software will be provided. Prerequisite: CUIIN 742. (F, S, S)

CUIIN-765. Authoring Software **Credit 3 (2-2)**
Students will utilize authoring software to create educational software or develop presentations. Students will import graphics, sound, and video into the authoring program and write appropriate script routines to implement a variety of actions within the program. Knowledge and usage of authoring software will enable students to create complex multimedia presentations or complex tutorial educational software. Prerequisite: CUIIN 617 or equivalent experience. (F, S, S)

CUIIN-766. Distance Education **Credit 3 (3-0)**
Students will learn about a variety of distance education delivery systems and methods. Different technological configurations will be addressed. Students will review the research on the effectiveness of varied distance delivery systems. (F, S, S)

CUIIN-767. Computer Lab Supervision and Management **Credit 3 (2-2)**
This course will provide students with an opportunity to explore different methods for supervising, managing, maintaining, organizing, and operating computer labs in schools. Prerequisite: CUIIN 617 or equivalent experience. (F, S, S)

ELED-750. Teaching and Learning in a Multicultural Classroom **Credit 3 (3-0)**
This course will focus on the incorporation of multicultural issues in the elementary school curriculum. Prerequisite: Completion of Phase I of the MS Degree Program in Elementary Education or permission of the instructor. (F, S, S)

CUIIN-776. Independent Reading in Education II **Credit 3 (3-0)**
Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)

CUIIN-777. Independent Reading in Education III **Credit 3 (3-0)**
Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)

CUIIN-780. Comparative Education **Credit 3 (3-0)**
Historical and international factors influencing the development of national systems of education and recent changes in educational programs of various countries. (F, S, S)

ELED-753. Advanced Social Studies **Credit 3 (3-0)**
This course will focus on approaches to the teaching of social studies in elementary school and the creation of a learning environment that will ensure that all students will learn fundamentals of social studies. Candidates will be required to conduct field research. (F, S, S)

CUIIN-782. Issues in Secondary Education **Credit 3 (3-0)**
An analysis of the role of the high school as an educational agency in a democracy. Attention is given to: (1) philosophical, psychological, and sociological bases for the selection of learning experiences; (2) contrasting approaches to curriculum construction; (3) teaching methods and materials; (4) evaluation procedures; and (5) school-community relationships. (F, S, S)

CUIIN-783. Current Research in Elementary Education **Credit 3 (3-0)**
A critical analysis of the current research in elementary education and the implications of such for elementary school educative experiences. (F, S, S)

CUIIN-784. Current Research in Secondary Education **Credit 3 (3-0)**
A critical analysis of the current research in secondary education and the implications of such for high school educative experiences. (F, S, S)

ELED 755. Teachers as Educational Leaders **Credit 3 (3-0)**
This course will focus on the attributes and dispositions of leadership for teachers. Action

research is required. Prerequisite: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

ELED 756. Assessment and Evaluation **Credit 3 (3-0)**

This course will focus on multiple modes of assessment and evaluation in elementary school. Prerequisite: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

CUIN-787. Independent Readings in Education III **Credit 3 (0-6)**

Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)

CUIN-790. Seminar in Educational Problems **Credit 3 (1-4)**

Intensive study, investigation, or research in selected areas of education; reports and constructive criticism. Prerequisites: A minimum of 24 hours in prescribed graduate courses. (F, S, S)

CUIN-791. Thesis Research (F, S, S) **Credit 3 (3-0)**

CUIN-999. Thesis (F, S, S) **Credit 1 (1-0)**

SPECIAL EDUCATION

SPED-660. Introduction to Exceptional Children **Credit 3 (3-0)**

This course provides an overview of the educational needs of exceptional, emphasis is placed on classroom techniques known to be most helpful to children having hearing losses, speech disorders, visual problems, emotional, social disabilities and intelligence deviation, including slow-learners and gifted children. An introduction to the area of special education. This course is designed for classroom teachers. (F, S, S)

SPED-661. Psychology of Exceptional Individuals **Credit 3 (3-0)**

An analysis of psychological factors affecting identification and development of individuals with high and low incidence disabilities. (F, S, S)

SPED-662. Mental Disability **Credit 3 (3-0)**

An overview of mental disabilities across the life span including etiologies, characteristics of various functioning levels, diagnosis, classification and placement, legal issues and current "best practices" for school and community inclusion. (F,S,S)

SPED-663. Measurement and Evaluation in Special Education **Credit 3 (3-0)**

The selection, administration, and interpretation of individual tests; intensive study of problems in testing exceptional and extremely deviant children; consideration is given to measurement and evaluation of children who are mentally, physically, and emotionally or socially handicapped. Emphasis is upon the selection and use of group tests of intelligence and the interpretation of their results. (F, S, S)

SPED-667. Specific Learning Disabilities **Credit 3 (3-0)**

This course will address specific learning problems associated with reading, writing, language, cognition, perception attention, and arithmetic, social, and emotional disabilities. (F, S, S)

SPED-668. Children & Youth with Behavioral Disabilities **Credit 3 (3-0)**

A study of issues, definitions, classification, characteristics, causes and prevalence of children and youth with behavioral disorders. It will examine models, assessment and intervention strategies.(F,S,S)

Electrical and Computer Engineering

John C. Kelly, Jr., Chairperson
551 McNair Building
(336) 334-7761

OBJECTIVE

The Master of Science Program in Electrical Engineering is designed to provide graduate level education for advanced professional practice or for further graduate studies. The program is open to students with a bachelor's degree in a scientific discipline from an institution of recognized standing. The Doctoral Program is the terminal degree within the Department of Electrical and Computer Engineering at North Carolina A&T State University. The educational objectives of these programs are as follows:

1. To provide master and doctoral levels of studies for students who completed their bachelor's or master's degrees from the North Carolina A&T State University, or an ABET accredited and equivalent university.
2. To provide local practicing electrical engineers from the Piedmont Triad, with a part-time graduate program in electrical engineering.
3. To provide the region with a full-time graduate electrical engineering program.
4. To foster research in electrical engineering for the benefit of North Carolina A&T State University and graduate students.
5. To enrich the undergraduate program as a result of student interaction with high quality engineering faculty concerned with graduate study and research.
6. To provide a graduate level electrical engineering resource base to support electrical engineering activities in local and regional industry and government.
7. To foster industrial development in the state and region through the offering of this program.

The programs emphasize areas of specialization, which are the current strengths of the department. Thus, the department concentrates the following four areas for the master and doctoral programs:

- Computer Engineering
- Communications and Signal Processing
- Electronic and Optical Materials and Devices
- Power Systems and Control

There are other academic programs within the university that are related to the graduate programs in Department of Electrical and Computer Engineering. They are important because they include academic subject matter of potential interest to students as supporting courses and areas of minor concentration. Specific degree programs include master's level programs in the following supporting areas:

- Applied Mathematics, Physics, Chemistry
- Computer Science
- Industrial Engineering
- Mechanical Engineering
- Architectural Engineering
- General (interdisciplinary) Engineering

DEGREES OFFERED

Master of Science - Electrical and Computer Engineering
Doctor of Philosophy - Electrical and Computer Engineering

ADMISSION REQUIREMENTS

ADMISSION REQUIREMENTS FOR MASTERS DEGREE PROGRAM

In order to pursue the degree of Master of Science in Electrical Engineering, one must first be admitted to the Graduate School. The first step toward Graduate School admission is to complete the required application forms and submit them to the Graduate School Office. In addition to the application forms, two official copies of the student's undergraduate and/or graduate transcript are required. An official GRE score is required for all overseas students. Satisfying the requirements described does not guarantee admission. Students are admitted solely by the department in three categories:

Unconditional Admission

An applicant may be given unconditional admission to the MSEE program if he/she possesses an undergraduate degree in Electrical Engineering from an ABET accredited institution with an overall GPA of 3.0 or better on a 4.0 scale. In addition, the applicant must have a 3.0 average in all engineering courses. International students who did not complete their B.S. degree program in this country may apply for unconditional status if they have at least a 85 percentile score on the GRE and do not require background work. Students will not be given unconditional status unless they take the GRE and submit the scores to the Graduate School.

Provisional Admission

Applicants may be granted provisional admission if they do not qualify for unconditional admission due to one or more of the following reasons:

- a) Applicant has a non-Electrical Engineering baccalaureate engineering degree with a GPA of 3.0 or better, but he/she is deficient in required background courses: (Note: Applicant must require more than 12 credit hours of background courses).
- b) Applicant does not have a degree from an ABET accredited curriculum, such as international students. A minimum GRE score of Verbal + Quantitative = 1100 is required.
- c) Applicant does not have a 3.0 overall GPA in Electrical Engineering. (Note: Applicant must have at least a 2.8 overall GPA).
- d) Electrical Engineering students having a GPA less than 2.8, but have minimum GRE Verbal + Quantitative scores of 1100.

A provisionally admitted student must achieve unconditional admission after completing all background courses and 9 graduate credit hours with an average of 3.0 or better. Upon the satisfaction of the above condition, the student may request through the Graduate Coordinator for conversion to the unconditional admission by the Graduate School.

All graduate students admitted in the Department of Electrical and Computer Engineering should meet with the Graduate Coordinator for assignment of a temporary advisor. The temporary advisor will assist the student in registration until the student selects a permanent advisor by mutual agreement between the student and the faculty member. Students must select a permanent advisor no later than 9 credit hours into the program. Approval by the Graduate Coordinator should then be obtained.

Provisional and PBS students must not take more than 12 graduate credit hours in Electrical Engineering prior to receiving unconditional admission to the MSEE program. It is the student's responsibility to request his/her status change from provisional or PBS status to graduate student status to the Graduate School through the Graduate Coordinator in the department. Students who fail to have their status upgraded run the risk of not receiving graduate credit for completed graduate courses

Post-Baccalaureate Studies (PBS)

This category applies to students lacking a baccalaureate degree in engineering and requiring 9-15 hours of prerequisites in general engineering background, but possessing a GPA of 3.0 or better from an accredited program.

Upon completion of the required background courses with a "B" average or better, these students may reapply to the graduate program. (Refer to Graduate Admissions and Section 9 for a list of the background courses.)

ADMISSION REQUIREMENTS FOR DOCTORAL DEGREE PROGRAM

All applications for admission to the Ph.D. program are subject to review by the Graduate Curriculum Development Committee in the Department. The GCD Committee's recommendation is not subject to further review. Satisfying the requirements described below does not guarantee admission. Denial of admission does not necessarily imply a negative evaluation of an applicant's qualification. Limited space, facilities, funding and mismatch in interest areas may place limits on the number of students admitted.

Unconditional Admission

The minimum admission requirements for Ph.D. program are as follows:

1. The student seeking a Doctor of Philosophy Degree in Electrical Engineering at North Carolina A&T State University must possess a Master of Science Degree in Electrical Engineering, Computer Engineering, or related disciplines;
2. The applicant should have an overall graduate GPA of 3.0 or better on a 4.0 scale;
3. The applicant must submit his/her GRE scores to the Department of Electrical and Computer Engineering;
4. The application must include three letters of recommendations, one of which must come from an individual knowledgeable of student's graduate performance and potential. The recommendations must be sent directly to the Department of Electrical and Computer Engineering in sealed envelopes;
5. International students from non-English speaking countries must submit TOEFL score of 550 or better.

Provisional Admission

Applicants may be granted provisional admission if they do not qualify for unconditional admission due to one or more of the following reasons:

- a) Applicant does not have a 3.0 overall GPA on his/her master degree. (Note: Applicant must have at least a 3.0 overall graduate GPA).
- b) Applicant's application package is incomplete.

However, the applicant must submit his/her GRE score to the Department of Electrical and Computer Engineering. The student in the provisional admission criteria must gain 3.5 GPA after 12 credit hours earned in less than a year. The status will then be changed to unconditional by requesting such change through the Graduate Coordinator.

MASTER DEGREE PROGRAM REQUIREMENTS

PROGRAM OPTIONS AND CREDIT-HOUR REQUIREMENTS

The Master of Science in Electrical Engineering program consists of three options: (a) Thesis Option, (b) Project Option, and (c) Course Only Option. The Thesis Option requires a minimum of 24 hours of coursework, at least 1 hour of 792, and 6 credit hours of master's thesis 797. The Project Option requires a minimum of 30 hours of coursework, at least 1 hour of 792, and 3 hours of 796. The Course Only Option requires 33 hours of coursework and at least 1 hour of 792. At least 12 credit hours for the thesis option and 15 credit hours for the project and course only options must be at or above the 700 level. A maximum of 6 hours of coursework can be taken outside the department, subject to approval by the student Advisory Committee.

SELECTION OF ADVISOR

At the beginning of the program, the student should meet with the Electrical Engineering Graduate Coordinator for assignment of a temporary advisor. The temporary advisor will assist the student in registration and course selection until the student selects a permanent advisor by mutual consent. Students should select a permanent advisor no later than 9 credit hours into the program.

THE GRADUATE PLAN OF STUDY FOR THE MASTER DEGREE PROGRAM

The student must submit the Graduate Plan of Study with the advisor's signature for his/her master degree program to the Electrical Engineering Office no later than the completion of 18 credit hours in the master degree program. Upon approval by the Graduate Coordinator in the Department of Electrical and Computer Engineering, the Graduate Plan of Study becomes the student's official guide to completing his/her master degree program.

CHANGE OF ADVISOR AND STUDY PLAN

The student can change his/her advisor at any time through mutual understanding between the student and a faculty member. However, after the submission of the Graduate Plan of Study, the student must submit the Graduate Study Plan Change Form with the signature of his/her advisor in case of changing the student's study plan and with both signatures of the previous advisor and the new advisor in case of changing advisor to the Electrical Engineering Office for approval by the Graduate Coordinator in the department. In particular, in the case of changing the student's advisor, the student must submit the revised Graduate Plan of Study with the signature of the new advisor.

THE ADVISORY COMMITTEE

The advisor together with the student will form the Advisory Committee for his/her thesis/project at least two weeks before the thesis/project defense. In general, the student's committee will have a minimum of three members for the thesis option and of two members for the project option. The chair of the Advisory Committee must be a faculty member in the Department of Electrical and Computer Engineering. It is expected that members will be selected such that they have both the time and the interest to assist the particular student. Only one member of the committee can be selected from outside of the department. A co-advisor can be selected from outside of the department for the student Advisory Committee. A co-advisor is responsible for the student's research work and financial support in a spirit of cooperation with the main advisor in the department. The main advisor is responsible for advising the overall plan of the student's degree program. However, a co-advisor from outside of department must apply in writing and be approved by the Graduate Curriculum Development (GCD) Committee in the Department of Electrical and Computer Engineering.

THESIS/PROJECT ORAL DEFENSE

The student must present his/her thesis/project work to the Advisory Committee for the thesis or project oral defense. In order to schedule the thesis/project oral defense, the student must submit the Thesis/Project Defense Notification with the signatures of all members of the Advisory Committee to the Department Office at least two weeks prior to the date of the oral defense. This notification must include the date, time and place of the oral defense. The student requesting his/her oral defense must distribute a copy of the thesis/project to all members of committee two weeks prior to the date of the oral defense. The copy of the defense notification approved by the Graduate Coordinator should to be sent to the student and the members of the committee from the Department Office for confirming the approval, date and place. The thesis/project oral defense must be conducted by the student's Advisory Committee with the approval of the Department Graduate Coordinator. Thus, if a committee member cannot attend a scheduled oral defense, it must be rescheduled. The location of a

thesis/project oral defense must be on-campus so that the presentation will be accessible to faculty, staff and students.

SUBMISSION OF THESIS/PROJECT

Upon passing the thesis/project oral defense, the student must have the thesis approved by the student's advisor and the chairman of Electrical and Computer Engineering Department. The thesis must be submitted to the School of Graduate Studies by the deadline given in the academic calendar, and must conform to the Guide for Preparation of Thesis, a copy of which may be obtained from the School of Graduate Studies Office or the Department Office. The student's project report for the project option must be submitted to the Electrical Engineering Office to change the grade report for the project course taken under his/her advisor.

SUMMARY OF PROCEDURES FOR THE MASTERS DEGREE PROGRAM

1. Apply for admission
 - (a) Complete application form.
 - (b) Pay application fee.
 - (c) Request and present all necessary official transcripts.
2. Receive Admission Status from the School of Graduate Studies.
3. See Graduate Coordinator for appointment of a temporary advisor.
4. Prepare course schedule for first term.
5. Complete all course deficiencies, if necessary.
6. Select permanent advisor, obtain advisor's approval and approval of Graduate Coordinator.
7. Consult with advisor to complete the Graduate Plan of Study for the master program.
8. Have the Graduate Plan of Study approved by advisor and Graduate Coordinator for his/her master program, and place on file with EE department office.
9. Complete course work.
10. Forming the Advisory Committee.
11. Schedule and complete:
 - (a) Final exam - if required *(See Note)
 - (b) Thesis/Project presentation and defense.
12. Gain approvals for the completion of all work.
13. Transmit the above information as necessary to
 - (a) School of Graduate Studies
 - (b) EE department office
14. Graduate

There may be circumstances where the Advisory Committee will deem it necessary and in the best interest of the student to require a written and oral final exam. Such circumstances may occur when a student has a handicap, when the research or project presented has unusual scope, or when other, not readily available talent, is needed to assess the student's results.

DOCTORAL DEGREE PROGRAM REQUIREMENTS

CREDIT-HOUR REQUIREMENTS

The Ph.D. program in Electrical Engineering is based on the Dissertation Option. This program requires 24 credit hours of coursework. At least 12 credit hours must be at the 800 level. A minimum of 12 credit hours of doctoral dissertation 997, 3 hours of 992 and 6 hours of 995 are required. No more than 6 credit hours at the graduate level in an area outside of electrical engineering will be accepted to satisfy a graduate area concentration as defined in section-9. Thus, total 45 credit hours are required for the doctoral degree. The student should be encouraged to take all courses related to the subjects selected for his/her qualifying exam.

DISSERTATION RESEARCH

There is no limit to the maximum number of dissertation credits for Ph.D. students. However, no more than 12 dissertation credits will be counted toward the 45 credit hours requirement described above. These credits alone do not constitute sufficient work at the dissertation/research level. Dissertation research cannot be initiated unless a student has maintained a 3.0 average or better.

SELECTION OF ADVISOR

At the beginning of the first semester, student must meet with Graduate Coordinator for the assignment of an advisor in the area of interest to the student. The advisor will then assist student with registration and course selection. By the end of the first semester or the first 9 credit hours, a permanent advisor must be identified.

DOCTORAL ADVISORY COMMITTEE

The advisor and the advisee must form the Advisory Committee in the second semester or before the student completes 12 hours of course work. The Advisory Committee for a Ph.D. student consists of a chairperson, three other members from the Department of Electrical and Computer Engineering for major subjects, and one member from outside of the department for a university minor subject. This Advisory Committee must include a Graduate School Representative selected from outside of the department in an area not related to the student’s thesis area. The Graduate School Representative will be appointed by the School of Graduate Studies for monitoring the fair evaluation of the exams for the student’s degree program. The Graduate School Representative attends the final oral examination and must sign the reports of the examination, but does not otherwise participate in directing the student’s technical work. The chair must be selected from the Department of Electrical and Computer Engineering based on the area of emphasis chosen by the student. Only one member of the committee may be selected from outside of the department. A co-advisor can be selected from outside of the department for the student Advisory Committee. A co-advisor is responsible for the student’s research work and financial support in a spirit of cooperation with the main advisor in the department. The main advisor is responsible for advising the overall plan of the student’s degree program. However, a co-advisor from outside of department must apply in writing and be approved by the Graduate Curriculum Development (GCD) Committee in the Department of Electrical and Computer Engineering.

THE GRADUATE PLAN OF STUDY FOR DOCTORAL PROGRAM

Before the student completes 12 credit hours of course work, the student and his/her advisor together must work out the Graduate Plan of Study for the student’s doctoral program and submit it with signatures of all members of the Advisory Committee to the Department Office. If the 12 credits are completed at the end of a regular semester, the Graduate Plan of Study must be submitted no later than one week before the beginning of pre-registration for the following semester. If the 15 credits are completed at the end of a summer session, the Graduate Plan of Study must be submitted before registration day for the following semester. The Graduate Plan of Study shows the committee chairperson, other committee members, and a sequential list of courses approved by the student’s advisor. Each member’s signature on the Graduate Plan of Study denotes their approval for the plan of the student’s doctoral program. Upon approval by the Graduate Coordinator in the Department of Electrical and Computer Engineering, the Graduate Plan of Study becomes the student’s official guide to complete his/her doctoral program, and the listed individuals form the Ph.D. Advisory Committee. However, the dissertation research work cannot be initiated unless student has maintained a 3.0 GPA average or better.

RESIDENCE REQUIREMENTS

Each Ph.D. student must secure at least two residence credits through registration in continuous semesters at North Carolina A&T State University. Residence credit is determined from the number of semester hours completed during a regular semester according to the following table. Summer registration is not required. However, residence credit for a six-week summer session equals one-half that of a regular semester. For example, completing a three-credit course during a six-week summer session will earn 1/6 of a regular semester residence credit.

Semester Credit Hours	Residence Credits
9 or more	1
6 – 8	2/3
less than 6 (including registration for “Thesis”)	1/3

CHANGE OF COMMITTEE MEMBERS AND STUDY PLAN

The student can change advisor at any time through mutual understanding between the student and a faculty member. If current Graduate Plan of Study has been previously approved and submitted, the student must submit the Graduate Study Plan Change Form to the Department Office of Electrical and Computer Engineering for approval by Graduate Coordinator with signatures of all Advisory Committee members in case of changing

the course list, and with signatures of both the previous Advisory Committee members and the new advisory group in case of changing any committee members. In the case of changing the student's advisor, the student must submit the revised Graduate Plan of Study with signatures of the new advisor and committee members.

Ph.D. QUALIFYING EXAMINATION

The purpose of the qualifying examination is to identify those who are qualified to work toward the Ph.D. degree in Electrical Engineering by requiring them to demonstrate basic competence in a broad range of relevant subjects. Students are not expected to engage in their research until they have passed the exam.

All students in the doctoral program must take the examination within two years plus one semester of his or her admission to the Ph.D. program. However, the students only with the unconditional status can apply the qualifying exam. Any students in the provisional status can not sit for the qualifying examination. They must first gain the unconditional status. A student must be enrolled with a 3.0 GPA or better at the time of the examination. A student must also have the approved Graduate Plan of Study for his/her doctoral program on file with the School of Graduate Studies prior to scheduling the exam. The qualifying examination is given each regular (Fall and Spring) semester on two successive days during the week before the final exam period. A registration notice will be posted outside the EE Office in the middle of each academic semester. Thus, the student must apply the qualifying exam two weeks prior to the date of exam. At the time of registration, the student will declare the track in which he or she will be taking the exam.

The examination consists of a three-hour written examination per subject, two subjects per day, and two consecutive days.

Ph.D. PRELIMINARY ORAL EXAMINATION

Each Ph.D. student must take a preliminary oral examination conducted by the student's Advisory Committee and attended by the Representative from the School of Graduate Studies. This is an oral presentation and defense of the student's dissertation proposal. Passing this exam allows the School of Graduate Studies to enter the student into "*Ph.D. Candidacy*." If a committee member cannot attend a scheduled preliminary oral, it must be rescheduled.

Unanimous approval by the Advisory Committee is required for passing the examination. Such approval may be conditioned on satisfactory completion of additional work. A student is actually admitted to candidacy for the Ph.D. degree only upon passing the preliminary examination or upon fulfilling any additional requirements imposed in connection with a conditional pass.

Failure of the examination terminates the student's graduate study unless the student's Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted and at least one full semester must elapse before the re-examination is held.

The examination may be held no earlier than the end (final exam week) of the second year of graduate study and no later than one semester (or four months) prior to the Ph.D. final oral examination.

The Preliminary Oral Examination is scheduled only at the request of the student and only upon the approval of the student's Advisory Committee. A student cannot submit a request to schedule an oral examination unless the student's Graduate Plan of Study has been approved by the Graduate Coordinator and the student has passed the Qualifying Examination. The student must be in good academic standing when the request is submitted and when the examination is held. The request must be submitted to the Electrical Engineering Office as soon as possible (after passing the Qualifying Examination), but at least two weeks prior to the date of the examination.

Ph.D. FINAL ORAL EXAMINATION

Each Ph.D. student must take a final oral examination conducted by the student's Advisory Committee and attended by a Representative from the School of Graduate Studies. This is the final dissertation defense presentation scheduled after the dissertation is completed. It consists of the defense of the methodology used and the conclusions reached in the research. If a committee member cannot attend a scheduled final oral, it must be rescheduled.

Unanimous approval by the Advisory Committee is required for passing an oral examination. Such approval may be conditioned on satisfactory completion of additional work. Failure of the examination terminates the student's graduate study unless the student's Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted.

The examination may be held no earlier than one semester (or four months) after admission to candidacy. The examination must be held on or before the deadline for final oral examinations (see the academic calendar in the Graduate Catalog) if the degree is to be awarded at the end of that semester, otherwise, the degree will be awarded at the end of the following semester.

The examination is scheduled only upon the request of the student and the approval of his or her Advisory Committee. The dissertation must be completed and copies of it must be distributed to the members of

the Advisory Committee before the request to schedule the examination is submitted to the Electrical Engineering Graduate Office. The request must be submitted to the EE Graduate Office at least two weeks prior to the date of the examination.

SUBMISSION OF DISSERTATION

Upon passing the Ph.D. Final Oral Examination, each Ph.D. student must have the dissertation approved by each member of the student's Advisory Committee. The dissertation must be submitted to the School of Graduate Studies by the deadline given in the academic calendar, and must conform to the Guide For Preparation of Thesis and Dissertations, a copy of which may be obtained from the EE Office. Submission of the Dissertation to the School of Graduate Studies is by appointment only.

SUMMARY OF PROCEDURES FOR THE DOCTORAL PROGRAM

1. Letter of inquiry from prospective student to the School of Graduate Studies or Department Chairperson.
2. Mailing proper forms to the student.
3. Receipt of application materials and required fee.
4. Review of application materials by the Graduate Curriculum Development (GCD) Committee in the department.
5. Department recommendation regarding applicant's admissibility to Graduate Dean.
6. The department's recommendation is reviewed and the student is notified of the action taken by the Dean of Graduate School.
7. Student reports to the department, is assigned an advisor and makes out a schedule of courses in consultation with Graduate Coordinator or the departmental advisor.
8. The student's Advisory Committee will have at least five faculty members; three members from the Department of Electrical and Computer Engineering, one of whom should be the chair, another represents the university minor field from outside of the department. The Advisory Committee will be joined by a Graduate School Representative from outside of the department not related with the student's thesis area in the Final Oral Examination. This Representative will sign the report of the examination, but is not a voting member.
9. The student in consultation with his/her Advisory Committee plans the course work in preparation of the Qualifying Examination. The student must submit the Plan of Doctoral Study to the department office before the Qualifying Examination with the approval of his/her Advisory Committee.
10. A dissertation subject and an outline of the proposed research are submitted to the student's Advisory Committee.
11. Four copies of the approved Graduate Plan of Study must be returned to the department office for approval at the end of the semester in which the student has completed 12 hours of course work. One copy is kept on file in the Department Office, one is returned to the committee chair, one is given to the student, and one is submitted the School of Graduate Studies.
12. After passing the Qualifying Examination, and when the direction of the student's dissertation topic has been determined, the chairperson requests the scheduling of the Preliminary Oral Exam at least two weeks prior to the suggested date. Upon approval of the request, a graduate faculty member is selected to represent the School of Graduate Studies at the examination, and the student and examining committee are notified of the time and place. The report of the examination is sent to the School of Graduate Studies and if the examination has been passed without conditions, the student is admitted to candidacy.
13. A copy of the preliminary draft of the dissertation is submitted to the chair of the student's Advisory Committee for review.

14. The diploma order request form must be filed with the School of Graduate Studies by the end of the third week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's not receiving the diploma at graduation.
15. At least two weeks prior to the Final Oral Examination, the chair of the student's Advisory Committee submits the dissertation to Advisory Committee members for review.
16. The examination may be held no earlier than one semester (or four months) after admission to candidacy. The examination is scheduled only upon the request of the student and the approval of his or her Advisory Committee. The dissertation must be completed and copies of it must be distributed to the members of the Advisory Committee before the request to schedule the examination is submitted to the Electrical Engineering Graduate Office. The request must be submitted to the EE Graduate Office at least two weeks prior to the date of the examination. Upon approval of the request, the student and the examining committee, including a School of Graduate Studies representative, are notified of the time and place of the examination. The School of Graduate Studies Representative receives a copy of the dissertation at least one week prior to the examination.
17. Three copies of the dissertation signed by each member of the student's Advisory Committee and five copies of the abstract must be submitted to the School of Graduate Studies by a specific deadline in the semester or summer session in which the degree is to be conferred. Specific deadline dates appear in the Calendar. One copy of each of the University Microfilms Agreement and the Survey of Earned Doctorate forms must be submitted with the dissertation.
18. The dissertation is reviewed by the School of Graduate Studies to insure that the format conforms to the specifications prescribed in the Guide for the Preparation of Theses.
19. All course work scheduled in a graduate degree classification must be completed prior to graduation.
20. A grade point average of at least 3.5 is required for graduation.
21. The statute of limitations for completion of degree requirements must not be exceeded (Refer to Section 12.2).

SUMMARY OF COURSE OFFERINGS

The 600 level courses numbered 600-699 are open to qualified seniors and graduate students for master program. Courses numbered 700 and above are only open to graduate students.

COURSE #	DESCRIPTION	CREDIT
ELEN 602	Semiconductor Theory and Devices	3 (3-0)
ELEN 606	Digital Electronics	3 (3-0)
ELEN 608	Analog Electronics	3 (3-0)
ELEN 614	Integrated Circuit Fabrication Methods	3 (3-0)
ELEN 615	Silicon Device Fabrication Laboratory	2 (1-3)
ELEN 621	Embedded Systems Design	3 (3-0)
ELEN 622	Embedded Systems Design Laboratory	2 (1-3)
ELEN 623	Digital Systems	3 (3-0)
ELEN 624	Computer Organization and Architecture Design	3 (3-0)
ELEN 629	VLSI Circuit Design	3 (3-0)
ELEN 630	VLSI Design Laboratory	2 (1-3)
ELEN 647	Introduction to Telecommunication Networks	3 (3-0)
ELEN 650	Digital Signal Processing I	3 (3-0)
ELEN 651	Digital Signal Processing Laboratory	2 (1-3)
ELEN 656	Probability and Random Processes	3 (3-0)
ELEN 657	Image Processing	3 (3-0)
ELEN 661	Power Systems Analysis	3 (3-0)
ELEN 662	Advanced Power Systems Laboratory	2 (1-3)
ELEN 668	Automatic Control Theory	3 (3-0)

ELEN 669	Control Laboratory	2 (1-3)
ELEN 674	Genetic Algorithms	3 (3-0)
ELEN 678	Introduction to Artificial Neural Networks	3 (3-0)
ELEN 679	Machine Intelligence Laboratory	2 (1-3)
ELEN 685	Selected Topics in Engineering	3 (3-0)
ELEN 686	Special Projects Var.	(1-3)
ELEN 701	Electronic Ceramics	3 (3-0)
ELEN 710	Wave and Fields in Radio Frequency (RF) and Optoelectronics	3 (3-0)
ELEN 720	Theoretical Issue in Computer Engineering	3 (3-0)
ELEN 721	Fault-Tolerant Digital System Design	3 (3-0)
ELEN 723	System Design Using Programmable Logic Devices	3 (3-0)
ELEN 724	Mixed-Signal VLSI Design	3 (3-0)
ELEN 727	Switching and Finite Automata Theory	3 (3-0)
ELEN 749	Digital Communications	3 (3-0)
ELEN 752	Wireless Information Networks	3 (3-0)
ELEN 762	Network Matrices and Graphs	3 (3-0)
ELEN 764	Power System Planning	3 (3-0)
ELEN 785	Master Special Topics	3 (3-0)
ELEN 792	Master Seminar	1 (1-0)
ELEN 793	Master Supervised Teaching	3 (0-3)
ELEN 794	Master Supervised Research	3 (0-3)
ELEN 796	Master Project	3 (3-0)
ELEN 797	Master Thesis Var.	(3-6)
ELEN 801	Solid State Devices	3 (3-0)
ELEN 802	Advanced Solid State Theory	3 (3-0)
ELEN 803	Compound Semiconductor Materials and Devices	3 (3-0)
ELEN 804	Semiconductor Material and Device Characterization	3 (3-3)
ELEN 805	Thin Film Technology for Device Fabrication	3 (3-0)
ELEN 810	Theory and Techniques in Photonics	3 (3-0)
ELEN 821	Advanced Computer Organization and Architecture	3 (3-0)
ELEN 822	Error-Correcting Codes	3 (3-0)
ELEN 823	Advanced VLSI Design	3 (3-0)
ELEN 847	Telecommunication Networks	3 (3-0)
ELEN 848	Information Theory	3 (3-0)
ELEN 849	Data Communications	3 (3-0)
ELEN 850	Digital Signal Processing II	3 (3-0)
ELEN 857	Pattern Recognition	3 (3-0)
ELEN 861	Power System Control and Protection	3 (3-0)
ELEN 862	Computer Methods in Power Systems	3 (3-0)
ELEN 865	Theory of Linear Systems	3 (3-0)
ELEN 866	Discrete Time Systems	3 (3-0)
ELEN 867	Neural Networks Design	3 (3-0)
ELEN 868	Intelligent Methods for Control Systems	3 (3-0)
ELEN 869	Machine Vision for Intelligent-Robotics	3 (3-0)
ELEN 870	Fuzzy Logic with Applications	3 (3-0)
ELEN 871	Nonlinear Control Systems	3 (3-0)
ELEN 885	Doctoral Special Topics	3 (3-0)
ELEN 992	Doctoral Seminar	1 (0-1)
ELEN 993	Doctoral Supervised Teaching	3 (0-3)
ELEN 994	Doctoral Supervised Research	3 (0-3)
ELEN 995	Doctoral Preliminary Examination	3 (0-3)
ELEN 997	Doctoral Dissertation Var.	(3-12)

DESCRIPTION OF GRADUATE COURSES
Under the Master and Doctoral Degree Programs in
Electrical and Computer Engineering

ELEN-602. Semiconductor Theory and Devices

Credit 3 (3-0)

This course is a study of the phenomena of solid-state conduction and devices using band models,

excess carriers in semiconductors, p-n junctions, and devices. Prerequisite: ELEN-460 or consent of instructor.

ELEN-606. Digital Electronics

Credit 3 (3-0)

This course covers analysis, design and applications of digital integrated circuits. These circuits may include resistor-transistor logic (RTL), diode transistor logic (DTL), transistor-transistor (TTL), emitter-coupled logic (ECL), metal-oxide-semiconductor (MOS) gates and n-channel MOS (NMOS) logic, complementary MOS (CMOS) logic, Bipolar CMOS (BiCMOS) structures, memory circuits, and interfacing circuits. Prerequisite: ELEN-460 or consent of instructor.

ELEN-608. Analog Electronics

Credit 3 (3-0)

This course covers the analysis, design and application of analog integrated circuits. These circuits may include operational amplifiers, voltage comparators, voltage regulators, Integrated Circuit (IC) power amplifiers, Digital to Analog (D/A) and Analog to Digital (A/D) converters, voltage-controlled oscillators, phase-locked loops, other special-function integrated circuits. Prerequisite: ELEN-460 or consent of instructor.

ELEN-610 Power Electronics

Credit 3(3-0)

Introduction to power semiconductor devices, naturally commutating converters, AC regulators, DC switching regulators, static power inverters, and application techniques. Prerequisite: ELEN-320.

ELEN-614. Integrated Circuit Fabrication Methods

Credit 3 (3-0)

This course presents the various processes utilized in the fabrication of semiconductor integrated circuits. Oxidation, diffusion, ion implantation, metallization, and epitaxial processes will be discussed. Limits on device design and performance will be considered. Prerequisite: ELEN-470 or consent of instructor.

ELEN-615. Silicon Device Fabrication Laboratory

Credit 2 (1-3)

Laboratory experiments in the fabrication of silicon p-n junction diodes, MOS capacitors and MOS field effect transistors will be performed. Oxidation, diffusion, photolithography, and metallization techniques will be presented. Co-requisite: ELEN-614.

ELEN-621. Embedded Systems Design

Credit 3 (3-0)

This course is a survey of modern methods for specifying algorithms, simulating systems, and mapping specifications onto embedded systems. It presents an introduction to the technologies used in the design and implementation of programmable embedded systems, such as programmable processors, cores, memories, dedicated and configurable hardware, software tools, schedulers, code generators, and system-level design tools. Prerequisite: ELEN-427 or consent of instructor.

ELEN-622. Embedded Systems Design Laboratory

Credit 2 (1-3)

This laboratory course is an introduction to developing processor-based embedded systems. The development tools include a C++ cross compiler, an Electronically Programmable Read Only Memory (EPROM) and an Application Specific Integrated Circuit (ASIC) programmer. A student project is part of the laboratory requirements. Co-requisite: ELEN-621.

ELEN-623. Digital Systems

Credit 3 (3-0)

Digital system top-down design and analysis will be presented. Topics include timing, power and performance issues in digital circuits, Very High Speed Integrated Circuit Hardware Description Language (VHDL)-based system analysis and synthesis, hardware-software co design, data-flow models and digital system primitives. Prerequisite: ELEN-427 or consent of instructor.

ELEN-624. Computer Organization and Architecture Design

Credit 3 (3-0)

This course covers the design of modern uniprocessors and their memory, and Input/Output (I/O) subsystems. Performance, microarchitecture, and design philosophies used to realize pipeline, superscalar, Reduced Instruction Set Computer (RISC) and Complete Instruction Set Computer (CISC) processors will be studied. Prerequisite: ELEN-427 or consent of instructor.

ELEN-629. VLSI Circuit Design

Credit 3 (3-0)

This course will study CMOS technology and device characteristics in order to develop layout design rules for VLSI circuit building blocks, such as inverters and logic gates. Layout techniques for complex gates and designing combinational and sequential logic circuits will be introduced. Prerequisite: ELEN-427 or consent of instructor.

ELEN-630. VLSI Design Laboratory **Credit 2 (1-3)**

This is an introduction of Computer Aided Design (CAD) tools for integrated circuit design and verification. These CAD tools include: geometric pattern generators, design rule checkers, circuit simulators and Programmable Logic Array (PLA) generators. A student design project is part of the laboratory requirements. Co-requisite: ELEN-629.

ELEN-647. Introduction to Telecommunication Networks **Credit 3 (3-0)**

This course introduces telecommunication networks utilization and design. Emphasis is on using and designing voice, video and image digital networks. Prerequisite: ELEN-400.

ELEN-650. Digital Signal Processing I **Credit 3 (3-0)**

This course develops a working knowledge of the basic signal processing functions, such as digital filtering spectral analysis, and detection/post-detection processing. Methods of generating the coefficients for digital filters will be derived. Alternate structures for filters, such as infinite impulse response and finite impulse response will be compared. The effect of finite register length will be covered. Prerequisite: ELEN-400 or consent of instructor.

ELEN-651. Digital Signal Processing Laboratory **Credit 2 (1-3)**

Experiments and student projects will be performed which are related to the practical applications of digital signal processing techniques to data acquisition, digital filtering, control, spectral analysis and communications. Co-requisite: ELEN-650.

ELEN-656. Probability and Random Processes **Credit 3 (3-0)**

This course covers probability, random variables, random processes, Gaussian processes, probabilistic description of signals and noise, including joint, marginal and conditional densities, autocorrelation, cross-correlation and power spectral density; linear and nonlinear transformations; linear least-squares estimation, and signal detection. Prerequisite: ELEN-310 or consent of instructor.

ELEN-657. Image Processing **Credit 3 (3-0)**

This course deals with concepts and techniques for digital image analysis and processing. Topics include image representation, image enhancement, edge extraction, image segmentation, geometric structure, feature extraction, knowledge representation, and image understanding. Prerequisite: ELEN-400 or consent of instructor.

ELEN-658 Digital Image Processing Laboratory **Credit 2(1-3)**

This laboratory course will demonstrate many important and practical applications of digital image processing techniques. The experiments include image enhancement, feature extraction, Hough transform, various transforms in spatial and frequency domains, image understanding and quantization. Co-requisite: ELEN-657.

ELEN-661. Power Systems Analysis **Credit 3 (3-0)**

The course studies power system representation, transmission lines, symmetrical and asymmetrical faults, electric power flow, power systems control and stability. Prerequisite: ELEN-430.

ELEN-662. Advanced Power Systems Laboratory **Credit 2 (1-3)**

In this laboratory course, basic concepts, transmission lines, power flows, faults, and transient and steady-state stability will be investigated. Prerequisite: ELEN-436 or consent of instructor. Co-requisite: ELEN-661.

ELEN-668. Automatic Control Theory **Credit 3 (3-0)**

This course introduces the theory of linear systems represented by state equations. Topics include Jordan canonical form, solutions to state equations, relationship to transfer functions,

stability, controllability, and pole placement design. Prerequisite: ELEN-410 or consent of instructor.

ELEN-669. Control Laboratory **Credit 2 (1-3)**

This laboratory course demonstrates methods of system identification and control. Verifications of control system designs in both the time domain and frequency domain will be studied. Co-requisite: ELEN-661.

ELEN-673 Application Specific Integrated Circuit (ASIC) Design **Credit 3(3-0)**

Students are introduced to the resource allocation issues and design options (i.e. floor planning, routing, number of logic blocks, etc.) associated with standard cell based realization of complex application specific integrated circuit/systems (ASIC) via modern synthesis and support tools. The relationship between the functionality and timing behavior of the synthesized designed over a range of system complexity and a variety of device architectures are also studied. Techniques to meet timing specifications are also covered in this course. Prerequisite: ELEN 423 and ELEN 429 or consent of instructor. **(F)**

ELEN-674. Genetic Algorithms **Credit 3 (3-0)**

This course covers the theory and application of genetic algorithms. Genetic algorithms combine a Darwinian survival-of-the-fittest with a randomized, yet structured, information exchange to form an improved search mechanism with surprising robustness. Engineering applications of genetic algorithms for design and control will be presented. Prerequisite: ELEN-410 or consent of instructor.

ELEN 675. Application Specific Integrated Circuit (ASIC) Design Laboratory **Credit 2(1-3)**

Students are introduced to the Electronic Design Automation (EDA) tools commonly used to realize Application Specific Integrated Circuits (ASIC) and the system design issues (i.e. floor planning, routing, clock skew, digital primitive space/performance tradeoffs, etc.). The limits of this design approach are also presented in this lab. Co-requisite: ELEN 673. **(F)**

ELEN-678. Introduction to Artificial Neural Networks **Credit 3 (3-0)**

This course introduces neural network design and development. Emphasis is on designing and implementing information processing systems that autonomously develop operational capabilities in adaptive response to an information environment. Prerequisite: ELEN-400 or consent of instructor.

ELEN-679. Machine Intelligence Laboratory **Credit 2 (1-3)**

This laboratory will explore the design and development of intelligent, autonomous, and physical agents. An emphasis will be placed upon machine intelligence experiments with visual sensors, tactile sensors, robotic manipulators and autonomous inexpensive mobile robots. Prerequisite: ELEN-433 or consent of instructor. Co-requisite: ELEN-678.

ELEN-685. Selected Topics in Engineering **Credit 3 (3-0)**

This lecture course is used to introduce engineering topics of current interest to students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: consent of instructor.

ELEN-686. Special Projects Variable **Credit (1-3)**

This is an investigation of an engineering topic which is arranged between a student and a faculty advisor. Project topics may be analytical and/or experimental and should encourage independent study. Prerequisite: consent of instructor.

ELEN-701. Electronic Ceramics **Credit 3 (3-0)**

This course introduces the properties of ceramic materials in electronic applications. The effects of processing parameters on the ultimate device characteristics will be investigated. Prerequisite: ELEN-602 or consent of instructor.

ELEN-710. Wave and Fields in Radio Frequency (RF) and Optoelectronics **Credit 3 (3-0)**

This course emphasizes principles, phenomena and methods relevant to RF and lightwave technology. The topics will include basic electromagnetic propagation in free space and material media, guided electromagnetic waves, modes and mode coupling, and Bragg and other types of

scattering. This course will establish the field principles of RF, integrated optic and fiber based devices and circuits. Prerequisite: ELEN-450 or ELEN-470 or consent of instructor.

ELEN-720. Theoretical Issues in Computer Engineering **Credit 3 (3-0)**

This course is designed to introduce some basic theoretical aspects of computer engineering. It includes selected topics in the set theory, elements of algebra such as semigroups, monoids, groups, rings, and fields, quotient groups and homomorphism theorems. It also includes finite state machines, the Myhill-Nerode theory, pseudo/random generators, linear feed back registers, introduction to error correcting codes and Turing Machines. Various applications will be demonstrated. Prerequisite: ELEN-427 or consent of instructor.

ELEN-721. Fault-Tolerant Digital System Design **Credit 3 (3-0)**

This course covers reliability, test generation, self-checking techniques, principles and applications of fault-tolerant design techniques. Prerequisite: ELEN-625 or consent of instructor.

ELEN-723. System Design Using Programmable Logic Devices **Credit 3 (3-0)**

This course will cover and compare many commercially available Programmable Logic Devices and consider their applications in both combinational and sequential logic system design. Students will also be familiarized with hardware description language such as VHDL and ABELTM and shown how design ideas can be efficiently translated into programmable hardware implementations. Prerequisite: ELEN-623 or consent of instructor.

ELEN-724. Mixed-Signal VLSI Design **Credit 3 (3-0)**

This course will introduce CMOS circuit techniques for low-power, low-voltage mixed-signal integrated circuits. Continuous-time signal processing, sampled-data analog filters, deltasigma data converters and mixed analog-digital layout techniques will be introduced. Prerequisite: ELEN-629 or consent of instructor.

ELEN-727. Switching and Finite Automata Theory **Credit 3 (3-0)**

This course presents the abstract mathematical modeling of combinational and sequential switching networks. Finite automata theory and fault tolerant concepts with applications to both combinational networks and finite state machines will be presented. Prerequisite: ELEN-427 or consent of instructor.

ELEN-749. Digital Communications **Credit 3 (3-0)**

The fundamental theory and applications of the digital communications system are discussed based on the knowledge of the probability theory. Topics in digital communications include sampling, quantizing, coding, detection, modulation/ demodulation, signal-to-noise ratio, and error probability. Prerequisite: ELEN-449 or consent of instructor.

ELEN-752. Wireless Information Networks **Credit 3 (3-0)**

Fundamental theory and applications of wireless mobile communication systems are covered for voice, data, and multimedia. Topics in wireless networks include characterization of radio propagation, source and channel coding, theory and analysis of wireless data networks, and wireless Local Area Networks (LANs). The wireless LANs discussion includes multiple access techniques and computer simulation of radio channels. Prerequisite: ELEN-452 or consent of instructor.

ELEN-762. Network Matrices and Graphs **Credit 3 (3-0)**

Use of vector space techniques in the description, analysis and realization of networks modeled as matrices and graphs. The course investigates vector space concepts in the modeling and study of networks. The system concept of networks is introduced and explored as a dimensional space consideration in terms of matrices and graphs. Prerequisite: ELEN-400 or equivalent.

ELEN-764. Power System Planning **Credit 3 (3-0)**

This course presents an overview of the issues and methods relevant to power systems planning. The course reviews the basics of financial analysis, regression analysis, forecasting, and reliability. Special topics relevant to power systems, such as deregulation, peak-load forecasts, load management and representation, and the loss-of-load probability (LOLP) method are also considered. Prerequisite: ELEN-661 or consent of instructor.

- ELEN-785. Master Special Topics** **Credit 3 (3-0)**
 This lecture course is used to introduce engineering topics of current interest to master students and faculty. The subject matter will be identified before the beginning of the course.
 Prerequisite: Consent of instructor.
- ELEN-792. Master Seminar** **Credit 1 (1-0)**
 Discussions and reports of subjects in electrical engineering and allied fields will be presented.
 Prerequisite: Master level standing.
- ELEN-793. Master Supervised Teaching** **Credit 3 (0-3)**
 Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.
 Prerequisite: Master level standing.
- ELEN-794. Master Supervised Research** **Credit 3 (0-3)**
 This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project or thesis topic of the master student. Prerequisite: Master level standing and consent of instructor.
- ELEN-796. Master Project** **Credit 3 (3-0)**
 The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students. Prerequisite: Master standing and consent of instructor.
- ELEN-797. Master Thesis** **Credit Variable (3-6)**
 Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Master thesis. This course is only available to thesis option students. Prerequisite: Consent of advisor.
- ELEN-801. Solid State Devices** **Credit 3 (3-0)**
 This course deals with p-n junction and Schottky barrier diodes, bipolar junction and field effect transistors, heterostructure devices (e.g., heterojunction bipolar transistors and solar cells), and device modeling and simulation. Prerequisite: ELEN-602 or consent of instructor.
- ELEN-802. Advanced Solid State Theory** **Credit 3 (3-0)**
 This course presents the physical properties of solids, including crystal lattice structure, atomic bonding, the band theory of electronic conduction, carrier mobilities, and scattering mechanisms. Prerequisite: ELEN-602 or consent of instructor.
- ELEN-803. Compound Semiconductor Materials and Devices** **Credit 3 (3-0)**
 This course presents the physics of compound semiconductors, epitaxial crystal growth, quantum well and superlattice devices, compound semiconductor FETs, and photonic devices. Prerequisite: ELEN-602 or consent of instructor.
- ELEN-804. Semiconductor Material and Device Characterization** **Credit 3 (3-0)**
 This course covers electrical, optical, and physical/chemical characterization of semiconductor materials and devices. Laboratory demonstrations will be presented on selected characterization techniques. Prerequisite: ELEN-602 or consent of instructor.
- ELEN-805. Thin Film Technology for Device Fabrication** **Credit 3 (3-0)**
 This course will focus on the preparation and properties of thin film electronic materials (dielectrics, metals, epitaxial layers). Topics will include: basic vacuum technology; theories of condensation, nucleation and growth of thin films; deposition techniques (chemical vapor deposition, vaporization, sputtering); epitaxial growth of semiconductor materials (molecular beam epitaxy, vapor phase epitaxy, liquid phase epitaxy); and applications of the deposition processes to the fabrication of heterostructure devices. Prerequisite: ELEN-602 or consent of instructor.
- ELEN-810. Theory and Techniques in Photonics** **Credit 3 (3-0)**

This course will concentrate on photonic materials such as semiconductors and oxide materials for opto-electronic integrated optic and nonlinear optic guided wave devices such as lasers, modulators and fibers. The course will also cover photonic systems for computing, communications, sensing, and data acquisition, processing and storage. Prerequisites: ELEN-450 or ELEN-470 and ELEN-602.

ELEN-821. Advanced Computer Organization and Architecture **Credit 3 (3-0)**

This course introduces the design and performance issues of array processors and multiprocessors. Very Long Instruction Word (VLIW), data-flow machines, array processors, interconnection networks and memory structures will be discussed. Prerequisite: ELEN-624 or consent of instructor.

ELEN-822. Error-Correcting Codes **Credit 3 (3-0)**

In this course, the basic principles of coding, such as error control schemes, coding in communication systems, and block coding, are studied. Linear block codes, polynomial algebra and cyclic codes, block codes based on finite field arithmetic, convolution codes, coding for bursty channels, coding for bandwidth limited channels, codes for computer memories and error detection and correction methods will be discussed. Prerequisite: ELEN-625.

ELEN-823. Advanced VLSI Design **Credit 3 (3-0)**

This course introduces the design of very high performance digital circuits, interconnect modeling, and packaging. Timing issues in digital circuits, designing memory and array structures, reliability and yield predictions, design synthesis, and validation and testing of VLSI circuits will be discussed. Prerequisite: ELEN-629 or consent of instructor.

ELEN-847. Telecommunication Networks **Credit 3 (3-0)**

The course familiarizes the student with the concepts of the International Standards Organization Open Systems Interconnection (ISO OSI) standards for the seven layer network model. This course introduces techniques for the analysis and optimization of computer networks, and illustrates some of the technical issues of current networks. Prerequisite: ELEN-647.

ELEN-848. Information Theory **Credit 3 (3-0)**

This course covers topics in classical information theory such as entropy, source coding, channel coding and rate distortion theory. Several related topics are discussed, including entropy for Markov sources and entropy for the extension of sources. Prerequisite: ELEN-749.

ELEN-849. Data Communications **Credit 3 (3-0)**

This course is an extended study of digital communications. Various topics in the upper level of digital communications, such as channel coding, synchronization, multiplexing, multiple access, and frequency spreading are discussed. Prerequisite: ELEN-749 or consent of instructor.

ELEN-850. Digital Signal Processing II **Credit 3 (3-0)**

This course deals with advanced topics in digital signal processing. Topics include the 2-D sampling theorem, the 2-D z-transform, the 2-D discrete Fourier transform, 2-D filters, and computational structures for the implementation of multi-dimensional digital signal processing algorithms. Prerequisite: ELEN-650 or consent of instructor.

ELEN-857. Pattern Recognition **Credit 3 (3-0)**

This course covers classical topics in statistical decision function, Bayesian learning, error probability estimation, cluster-seeking, and deterministic approach. Several related topics are discussed, including stochastic approximation, feature selection and ranking, syntactic and structural pattern recognition. Prerequisite: ELEN-657.

ELEN-861. Power System Control and Protection **Credit 3 (3-0)**

This course deals with power and voltage control systems, and power systems protection by relays. Related topics are also covered. Prerequisite: ELEN-661 or ELEN-668.

ELEN-862. Computer Methods in Power Systems **Credit 3 (3-0)**

This course deals with commercially available software for modeling and analysis of electric

power systems. Prerequisite: ELEN-661 or equivalent.

ELEN-865. Theory of Linear Systems **Credit 3 (3-0)**

This course introduces modern control system design and analysis. Topics include linear-quadratic regulators, state estimators, and discrete-time control systems. Issues discussed include stability, robustness, and optimality. Prerequisite: ELEN-668 or equivalent.

ELEN-866. Discrete Time Systems **Credit 3 (3-0)**

In this course, analyses and syntheses of discrete time systems are carried out using Z-transform and state variable representations. The controllability and observability, stability criteria, sampled spectral densities and correlation sequence, optimum filtering and control of random processes are discussed. Prerequisite: ELEN-668 or equivalent.

ELEN-867. Neural Networks Design **Credit 3 (3-0)**

This course covers the design of neural network systems using CMAC (Cerebellum Model Articulation Controller), back propagation, and multifunction hybrid networks. Prerequisite: ELEN-678 or equivalent.

ELEN-868. Intelligent Methods for Control Systems **Credit 3 (3-0)**

The course covers advanced control methods for dynamic systems. The focus will be on intelligent control algorithms, and adaptive and self-learning methods. Stability analysis and performance simulation will also be addressed. Prerequisite: ELEN-668 or consent of instructor.

ELEN-869. Machine Vision for Intelligent-Robotics **Credit 3 (3-0)**

This course is a study of visual/non-visual sensor technologies for the intelligent control of a robot. The course will cover image understanding, non-contact sensor analysis, and data fusion for intelligent robotics system design. Prerequisite: ELEN-657.

ELEN-870. Fuzzy Logic With Applications **Credit 3 (3-0)**

The course objective is to understand the basic theory and the foundations of fuzzy sets. Fuzzy logic is shown to contain evidence, possibility, and probability logic. This course emphasizes engineering applications in control, decision-making, and pattern recognition. The hardware/software implementation of those applications is also demonstrated. Prerequisite: ELEN-668 or consent of instructor.

ELEN-871. Nonlinear Control Systems **Credit 3 (3-0)**

This course explores the basic issues of nonlinear system analysis and control. The course will introduce the general characteristics of nonlinear behavior and some of the tools needed to analyze and understand them. It will also introduce basic concepts of stability theory, especially Lyapunov's. Some basic design techniques for the control of these systems, such as the sliding mode method and feedback linearization will be introduced. Prerequisite: ELEN-668 or consent of instructor.

ELEN-885. Doctoral Special Topics **Credit 3 (3-0)**

This lecture course is used to introduce engineering topics of current interest to doctoral students and faculty. The subject matter will be identified before the beginning of the course. Prerequisites: Doctoral student and consent of instructor.

ELEN-992. Doctoral Seminar **Credit 1 (0-1)**

In this course, doctoral students attend colloquia or seminars. These consist of presentations by doctoral students on dissertation topics and works-in-progress and by guests on important classical, contemporary or research problems in electrical engineering. Prerequisite: Doctoral level standing.

ELEN-993. Doctoral Supervised Teaching **Credit 3(0-3)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Doctoral level standing.

ELEN-994. Doctoral Supervised Research **Credit 3 (0-3)**

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisites: Doctoral level

standing and consent of instructor.

ELEN-995. Doctoral Preliminary Examination

Credit 3 (0-3)

This course is for students who are preparing for and taking the written and/or oral preliminary examination. Prerequisites: Doctoral student and consent of advisor.

ELEN-997. Doctoral Dissertation Variable

Credit (3-12)

This supervised research serves as the dissertation of the doctoral student. Twelve credits of dissertation are required for graduation. Prerequisites: Doctoral student and consent of advisor.

Electronics, Computer, and Information Technology

<http://www.ncat.edu/~ecit>

Derrek B. Dunn, Chairperson

OBJECTIVES

The Department of Electronics, Computer, and Information Technology (ECIT) prepares students to pursue technical, as well as technical management careers in all employment sectors. The program emphasizes acquisition of sound theoretical studies, as well as intensive “hands-on” experiences in the area of electronics technology. The ECIT Department emphasizes development of “real world” competencies demanded by employers. Students receive thorough grounding in electronics; digital and microprocessor systems; computer technologies, including hardware, software and computer networking; communication systems; and automation and control systems. Additional emphasis is placed on courses in business management, statistics, and project management. Such courses instill an appreciation for the economic and managerial aspects of the business enterprise.

DEGREES OFFERED

Information Technology – Master of Science in Industrial Technology

Electronics and Computer Technology – Master of Science in Industrial Technology

CERTIFICATE IN RADIO FREQUENCY & MICROWAVE WIRELESS COMMUNICATION SYSTEMS

The Department of Department of Electronics, Computer, and Information Technology administers’ the Certificate in Radio Frequency and Microwave Wireless Communication Systems. The certificate program in Radio Frequency and Microwave Wireless Communication Systems requires a total of 15 semester hours to complete. Under the supervision of a certificate faculty advisor, students will take 6 credits of required core courses, select 6 credits hours of elective courses and complete a required 3 credit hour independent study focusing on one or more selected wireless topics. The 3 credit hours of independent study would assure that the certificate program maintains a certain level of “hands-on” training by requiring students to complete a project. (Note: Upon departmental certificate advisor approval, substitutions may be allowed for courses not on the list below, if consistent with the certificate’s intent.)

Required Core Courses (6 hours): ECT 650 and 665

Elective Courses (6 hours): ECT 634, 655, 660, 670, 675, 680, and 690

Required Project Course (3 hours) ECT 699

PROGRAM DESCRIPTION

The School of Technology at North Carolina A&T State University offers a Master of Science in Industrial Technology (MSIT) degree. This program is designed to increase students’ understanding of industrial management challenges in an array of technical areas and to explore effective methods for dealing with accelerated technological change.

ADMISSION REQUIREMENTS

The Master of Science in Industrial Technology, within the School of Technology, requires the GRE General Test as part of the admission process. No minimum score is required at this time. Please contact the Graduate School Office for more information.

DEPARTMENT REQUIREMENTS

The Master of Science in Industrial Technology degree program with concentrations in Information Technology or Electronics and Computer Technology offers three options: the thesis option, the project option and the course work option. The thesis option requires a minimum of 36 semester hours. The project option requires a minimum of 39 semester hours. The course work option requires a minimum of 42 semester hours. All options required students to pass a written comprehensive examination. In addition, at least fifty percent (50%)

of the courses counted towards the Master of Science in Industrial Technology degree must be numbered 700 and above and students must maintain and complete the Master of Science in Industrial Technology program with an overall GPA of 3.0 or better on a scale of 4.0. Up to six semester hours of graduate work may be transferred from another university, provided it was not a part of any prior undergraduate degree requirement. The course content must adequately replace current graduate offerings in the student's curriculum. Transfer credits should be at a level comparable to 600 or 700 level courses at North Carolina A&T.

PROGRAM CURRICULA

Program	Option	Core Courses	Management Electives	Additional Statistics Requirement	Technical Electives	Comprehensive Examination Course	Required Courses
Electronics and Computer Technology	Thesis	12 credits	6 credits	3 credits	9 credits	Required	6 credits
	Project				9 credits		9 credits
	Coursework				21 credits		
Information Technology	Thesis	12 credits	6 credits	3 credits	9 credits	Required	6 credits
	Project				9 credits		9 credits
	Coursework				21 credits		

Core Courses

MSIT 610	Problem Solving in Industrial Technology
MSIT 700	Concepts of Technological Innovations
MSIT 740	Leadership Development Seminar
MSIT 779	Statistical and Research Methods in Industrial Technology I

Management Electives

ECT 730	Systems Integration for Telecommunications Managers
ECT 735	Telecommunications Management Issues
ECT 785	Electric Energy and Environmental Management
ITT 620	Telecommunications Management
ITT 625	Computer Database Management
ITT 685	Ethical Aspects of Information Technology
ITT 740	Regulatory and Policy Issues for Communication Systems

Additional Statistics Requirement

(Student is to select an additional statistics course from any SOT department or with prior approval, any NCA&TSU department)

MSIT 780	Statistical and Research Methods in Industrial Technology II
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Technical Electives-Electronics and Computer Technology

(Student is to select technical elective courses from any SOT department or with prior approval, any NCA&TSU department)

General Technology Specialization

ECT 685	Energy, Power and The Environment
ECT 690	Special Problems in Electronics and Computer Technology
ECT 695	Alternate Energy Systems
ECT 699	Independent Study in Electronics & Computer Technology
ECT 759	Special Topics in Electronics & Computer Technology

Computer Information Technology Specialization

ITT 629	Computer Networking I
ITT 630	Computer Networking II
ITT 725	Wide Area Networks
ITT 745	Network Services for the Enterprise

BUED 624 E-commerce Design and Implementation

Telecommunications Technology Specialization

ITT 601 Wireless Application Protocols I
ITT 610 Digital Communications I
ITT 611 Digital Communications II
ITT 650 Wireless Communication Systems I
ITT 655 Optical Communication Systems I
ITT 660 Satellite and Personal Communication Systems
ITT 665 Wireless Geo-location Systems I
ITT 670 Communication Circuit Development Laboratory I
ITT 675 Video Communication Systems
ITT 680 Radio Wave and Optical Signal Propagation
ITT 755 Optical Communication Systems II
ITT 760 Wireless Communication Systems II
ITT 765 Wireless Geo-location Systems II
ITT 770 Communication Circuit Development Laboratory II

Microelectronics and Materials Technology Specialization

ECT 614 Microelectronic Fabrication Technology
ECT 615 Introduction to Semiconductor Manufacturing Equipment Technology
ECT 616 Applied Materials, Semiconductor, Superconductivity
ECT 617 Advanced Solid State Devices
ECT 714 Advanced VLSI, Film, and IC Process Technology

Control and Systems Technology Specialization

ECT 600 Electromechanical Systems Analysis
ECT 634 Electronic Instrumentation for Remote Sensing Applications
ECT 635 Analysis and Design of Mechatronic Systems
ECT 640 Electronic Automated Testing Systems

Technical Electives- Information Technology

(Student is to select technical elective courses from any SOT department or with prior approval, any NCA&TSU department)

Computer Technology Specialization

Software Systems

BUED 624 E-Commerce Design and Implementation
CUIN 760 Programming in BASIC
CUIN 761 Programming in LOGO
GCS 632 Graphic Animation
INEN 625 Information Systems

Networking

ITT 605 Principles of Computer Networking
ITT 629 Computer Networking I
ITT 630 Computer Networking II
ITT 635 Administration and Security of Wireless Local Area Networks I
ITT 640 Administration and Security of Wireless Local Area Networks II
ITT 645 Analysis and Troubleshooting of Wireless LAN Systems

Security

ITT 615 Networking Security Applications
COMP 620 Information, Privacy and Security
COMP 627 Wireless Network Security

Animation/Graphics

GCS 632 Graphic Animation
ITT 601 Wireless Application Protocols

Telecommunications Technology Specialization

Digital

ITT 610	Digital Communications I
ITT 611	Digital Communications II

Wireless

ITT 601	Wireless Application Protocols
ITT 635	Administration and Security of Wireless Local Area Network I
ITT 640	Administration and Security of Wireless Local Area Network II
ITT 645	Analysis and Troubleshooting of Wireless LAN Systems
ITT 650	Wireless Communication Systems
ITT 655	Optical Communication Systems
ITT 660	Satellite and Personal Communication Systems
ITT 665	Wireless Geo-location Systems
ITT 755	Optical Communication Systems II
ITT 760	Wireless Communication Systems II
ITT 765	Wireless Geo-location Systems II

Systems

ITT 670	Communication Circuit Development Laboratory I
ITT 675	Video Communication Systems
ITT 680	Radio Wave and Optical Signal Propagation
ITT 770	Communication Circuit Development Laboratory II

Required Comprehensive Examination Course

ECT 788 Master's Comprehensive Examination

Required Courses

Project Option:

MSIT 750 or ECT 750	Internship I or Telecommunications Co-op
MSIT 751	Internship II
MSIT 789	Master's Degree Project

Thesis Option:

MSIT 791	Thesis I
MSIT 792	Thesis II

COURSE DESCRIPTIONS IN ELECTRONICS AND COMPUTER TECHNOLOGY (ECT)

Undergraduate/Graduate

ECT 600. Electromechanical Systems Analysis

Credit 4(4-0)

This course deals with the fundamentals of electrical and mechanical dynamical systems. Frequency and time domain analysis techniques are utilized. Electrical and mechanical applications of first and second order linear differential and difference equations are examined through transform techniques. Specialized applications software packages are examined. Prerequisites: DEPARTMENTAL APPROVAL (F;S;SS)

ECT 614. Microelectronic Fabrication Technology

Credit 3(1-4)

This course provides basic lab works on processes as wafer preparation, oxidation, photolithography, doping and deposition used in semiconductor device fabrication. Wafer test equipments, measurement/evaluation techniques, as well as clean room microcontamination control and operation/safety practices are taught through industry field trips and hands-on experiments. Economics and industrial production control issues are examined. Students project on simple mask-making, and fabricating a working transistor - based IC. Prerequisites: ECT 314 or ECT 414. (F;S;SS)

ECT 615. Introduction to Semiconductor Manufacturing Equipment Technology

Credit 3(1-4)

This course teaches basic industrial instrumentation (electrical and non-electrical) and automation, as well as associated fundamental concepts used to develop various applications for the semiconductor industry. This course covers various industrial applications including: Vacuum theory and technology, Design and Installation of industrial clean room facilities and equipments for photolithography, CVD/PVD, RF plasma, etc.. Prerequisites: ECT 360, ECT 414 (F;S;SS)

ECT 616. Applied Materials, Semiconductors, and Superconductivity Credit 3(2-2)

This course covers band theory of solids, crystal imperfections; mechanical and thermal properties; microscopic theory of conductivity, polarizability, permeability, including high frequency effect; Elemental and compound semiconductors; Introduction to BCS theory of superconductivity, Josephson tunneling, type II superconductors. Laboratory experiments conducted in the course includes: basic measurements of mechanical, chemical, thermal, electrical and magnetic properties of various electronic materials; fabrication and testing of solar cells, Josephson junction, cryogenics, and vacuum deposition of films. Prerequisites: PHYS 225, 226, 235, 236 (F;S;SS)

ECT 617. Advanced Solid State Devices Credit 3(2-2)

This course covers band model and carrier transport in semiconductors; excess carriers; Interfaces; Physics of the p-n junction and MOS sandwich; IC design at low frequencies for TTL, CMOS, and analog circuitry. The course also includes a broad review of the theory/design/fabrication of monolithic, film, heterojunction, and high frequency semiconductor devices involving quantum dots/wires, mesoscopic devices, Rf Gunn effect, laser sources etc. for integrated optics, nanotechnology, and quantum computing. Students shall use advanced simulation tools for extensive numerical modeling of semiconductor devices and fabrication processes. Prerequisites: ECT 414 (F;S;SS)

ECT 635. Analysis and Design of Mechatronic Systems Credit 3(1-4)

This course deals with the principles of analyzing and designing mechatronics systems. This course includes a review of logic gates, microprocessor architecture, sensors and actuators, A/D and D/A conversion techniques, real-time multi-tasking programming concepts, and direct digital control implementation. The course includes "hands-on" experiences through several laboratory assignments and a final team project. Prerequisites: ECT 201, ECT 312, ECT 313. (F;S;SS)

ECT 640. Electronic Automated Testing Systems Credit 3(2-2)

This course addresses the fundamentals of electronic automated testing systems. Topics include: Production, reliability, and maintenance testing. Various types of Automated Test Equipment (ATE) are addressed, including Built in Test Equipment (BITE) and stand alone systems. Prerequisites: ECT 360. (F;S;SS)

ECT 685. Energy Power and the Environment Credit 3(3-0)

This course will cover the basic concepts of electric power generation, utilization, and power networks. How total energy consumption and the global economy, affects the environment will be studied. Prerequisite: ECT 355 (F;S;SS)

ECT 690. Special Problems in Electronics and Computer Technology Credit 3(3-0)

This lecture course is used to introduce new topics in the field of electronics and computer technology. The subject matter will be identified prior to the beginning of the course. Prerequisite: Departmental Approval. (F;S;SS)

ECT 695. Alternate Energy Systems Credit 3(3-0)

This course will cover the production of electric energy from alternate energy sources including solar, wind, hydro, biomass, geothermal and ocean. Also, this course will provide the background knowledge of the characteristics of direct conversion, electromechanical conversion, and storage devices used in alternate energy systems. This course will also cover power system issues associated with integration of small scale energy sources into the electricity grid will be fully investigated. Prerequisite: ECT 355 or Departmental Approval (F;S;SS)

ECT 699. Independent Study in Electronics and Computer Technology Credit 3(3-0)

The student selects a problem (technical or managerial) in consultation with a faculty member in an area related to Electronics Technology or Computer Technology or Telecommunications or Networking. The

student along with the faculty member defines the problem's objectives and a solution is pursued.
Prerequisite: Graduate Standing. (F;S;SS)

Graduate

ECT 714. Advanced VLSI, Film, and IC process Technology **Credit 3(3-0)**
This course introduces computer aided design tools for VLSI; Mask design styles, layout editors, placement/routing, design rule checking, etc.; thick films, advanced PVD/CVD systems; advanced lithographic and IC process techniques. The course also presents application to low frequency, Rf, and optical frequency micro- and nano- electronic devices. Prerequisite: ECT 614 or 615 (F;S;SS)

ECT 730. Systems Integration for Telecommunications Managers **Credit 3(2-2)**
This course delineates methods by which telecommunications systems can be put together to serve the needs of an organization. Students trace how the project manager should operate under constraints of time, cost, performance, competition, and regulation. The course involves extended case studies and group project. Prerequisites: ECT 620 (F;S;SS)

ECT 735. Telecommunication Management Issues **Credit 3(2-2)**
This course assesses the impact of current and future trends on telecommunication landscape. Topics include technological changes, strategic planning, financial analysis, and the roles of organizational entities such as research and development, production, human resources, and operations. Prerequisite: ECT 620 (F;S;SS)

ECT 740. Regulatory and Policy Issues for Communication Systems **Credit 3(2-2)**
This course examines current codes and procedures in sampling, engineering standards, testing procedures and guidelines. Data analysis using computer modeling and statistical analysis will be presented. Prerequisite: Departmental Approval (F;S;SS)

ECT 750. Telecommunications Co-op **Credit 3(3-0)**
The co-op experience is designed to provide students with an intern experience of working full-time in a technical environment related to electronics and computer technology or telecommunications. For 3 hours of credit, the student must be employed full-time for one semester. Evaluation of student will be based on reports from student's work supervisor and co-op coordinator. Prerequisite: 15 hours of graduate credit. (F;S;SS)

ECT 759. Special Topics in Electronics and Computer Technology **Credit 3(3-0)**
This course involves the study of a topic not addressed by an existing course in the department. Typically, a topic is selected from within a new or evolving area in the field. Prerequisite: Departmental Approval. (F;S;SS)

ECT 785. Electric Energy and Environmental Management **Credit 3(3-0)**
This course will discuss the role of electricity from fossil and nuclear fuels, and renewable resources. It will investigate the impact of high voltage transmission lines as well as the health effects of electricity generation. The course will do an assessment of cogeneration cycles and demand side management. In addition, emission control in the US electric utility industry and an evaluation of uncertainties in quantifying emissions impacts will be studied. Prerequisites: ECT 685 or Departmental Approval (F;S;SS)

ECT 788. Master's Comprehensive Exam **Credit 0(0-1)**
This course will aid in the preparation of the graduate student to take the Master of Science in Industrial Technology (MSIT) comprehensive examination. The examination will be administered towards the end of the semester or summer session. This course will be graded on a Pass/Fail basis. The passing of this course is a requirement for graduation from the MSIT program. Prerequisites: 24 credit hours of graduate level courses. (F;S;SS)

**COURSE DESCRIPTIONS IN INFORMATION AND TELECOMMUNICATION TECHNOLOGY
(ITT)**

Undergraduate/Graduate

- ITT 600. Project Management for Information Technology** **Credit 3(3-0)**
This course delves into the unique challenges of managing information technology projects, and offers a road map to success. The course is specifically designed to address the skills inventory and performance outcomes that a student needs to be successful in today's volatile information technology market.
Prerequisite: Senior standing (F;S;SS)
- ITT 601. Wireless Application Protocols** **Credit 3(2-2)**
This course takes you through the basics of Wireless Application Protocols (WAPs), and provides all the information needed to create WAP pages using the Wireless Markup Language (WML). The course will include an introduction to WAP and WML, cards and decks, text formatting elements, navigational commands in WML, and WML variables. Prerequisites: ECT 201 and Junior Standing (F;S;SS)
- ITT 605. Principles of Computer Networking** **Credit 3(2-2)**
This course explores all the hardware and software that drives local and Internet computing. Special emphasis is placed on connectivity and throughput. Prerequisites: ECT 313 (F;S;SS)
- ITT 610. Digital Communications I** **Credit 3(2-2)**
The class will investigate digital communications systems for various signals including audio, video and data. Topics include: sampling, quantization, multiplexing, coding, modems, various compression schemes, signal impairments, and various digital modulation schemes. Prerequisites: ECT 350 (F;S;SS)
- ITT 611. Digital Communications II** **Credit 3(2-2)**
This course is a continuation of ECT 610. Emphasis is placed on multimedia networks and their supporting platforms. Topics include audio and video standards and compression schemes, cable modems and xDSL schemes. Prerequisites: ECT 610 or departmental approval (F;S;SS)
- ITT 615. Networking Security Applications** **Credit 3(2-2)**
This course explores security terms, definitions, concepts, and issues that face industries today. This course also will examine how the concept of security, and being secure, integrates into the overall enterprise mission. The importance of user involvement, security training, ethics, trust, and informed management will be explored. Prerequisites: ITT 605 (F;S;SS)
- ITT 620. Telecommunications Management** **Credit 3(2-2)**
This course addresses fundamental principles of telecommunications management, which includes network management and administration, the telecommunications marketplace, and the planning and evaluation of systems. The technology of modern telecommunications systems is also reviewed. Prerequisites: ECT 350. (F;S;SS)
- ITT 625. Computer Database Management** **Credit 3(2-2)**
This course focuses exclusively on the design and system issues related to distributed database systems. Students will learn the usage of different design strategies for distributed databases, and they will study query processing techniques and algorithms as well as transaction management and concurrency control concepts used in such systems. Design and implementation issues related to multidatabase systems also will be discussed. In addition, the course focuses on applying the techniques learned in course to commercial database management systems. Prerequisites: ITT 600 (F;S;SS)
- ITT 629. Computer Networking I** **Credit 3(2-2)**
This course introduces the student to Local Area Networks (LAN) and introduction to Wide Area Networks (WAN). The course also will provide the basic understanding of network concepts and router programming. Prerequisite: ECT 212 and ECT 213 or ECT 299 (F;S;SS)

ITT 630. Computer Networking II**Credit 3(1-4)**

The course covers the advanced study of Local Area Networks (LAN) and Wide Area Networks (WAN). The students will develop competences in designing and implementing enterprise-wide networks using routers and switches. Prerequisites: ITT 629. (F;S;SS)

ITT 634. Electronic Instrumentation for Remote Sensing Applications **Credit 3(2-2)**

This course will provide practical knowledge of the operation of electronics instruments used in the applications of telemetry, remote sensing and detection. Possible electronic systems that will be discussed include RADAR, SONAR, LIDAR, and SODAR. Prerequisites: ECT 350 or departmental approval (F;S;SS)

ITT 635. Administration and Security of Wireless Local Area Network I **Credit 3(2-2)**

This course will introduce students to wireless network protocols, access modes, portable communications and computing devices, management tools, security solutions, and current industry best practices for managing wireless networks in a secure environment. Case studies will be used throughout the course. Prerequisites: ECT 350 (F;S;SS)

ITT 640. Administration and Security of Wireless Local Area Network II **Credit 3(2-2)**

A continuation of ITT 635, this course provides students with an in-depth understanding of the security vulnerabilities to wireless networks and their corresponding countermeasures. This course includes training on practical methods for designing, configuring, testing, and maintaining wireless networks appropriate to their organizations' operating requirements. Prerequisites: ITT 635 (F;S;SS)

ITT 645. Analysis and Troubleshooting of Wireless LAN Systems **Credit 3(1-4)**

This course presents an in-depth understanding of the frame structure of 802.11 frames, frame exchange processes between wireless nodes, analyzing security solutions for both effectiveness and weaknesses, analyzing performance in both pure and mixed-mode environments, and using analyzers for site surveying and intrusion detection. ITT 635 (F;S;SS)

ITT 650. Wireless Communication Systems I **Credit 3(2-2)**

This course covers fundamental theory and design of high capacity wireless communication systems. Topics include trunking, propagation effects, frequency reuse, modulation methods, coding and equalization. Emerging cellular and next generation personal communication systems will also be analyzed. Prerequisites: ECT 350 (F;S;SS)

ITT 655. Optical Communication Systems I **Credit 3(2-2)**

This course covers free space and fiber optic technologies (including lasers, optical amplifiers and optical filters) with applications to high-speed long distance systems, local area networks and communication systems. Prerequisites: ECT 350 (F;S;SS)

ITT 660. Satellite and Personal Communication Systems **Credit 3(2-2)**

This course covers the theory and practice of satellite communications including: orbits, launchers, spacecraft link budgets, modulation techniques, coding, multiple access techniques, propagation effects and earth terminals. Prerequisites: ECT 350 (F;S;SS)

ITT 665. Wireless Geo-location Systems I **Credit 3(2-2)**

This course will describe the basic concepts and mechanics of Global Positioning Systems (GPS) and Inertial Navigation Systems (INS). Practical applications of GPS, INS and GPS/INS will be covered. Simple algebraic mathematical calculations will be completed. Prerequisites: ECT 350 or departmental approval (F;S;SS)

ITT 670. Communication Circuit Development Laboratory I **Credit 3(1-4)**

This course studies advanced methods of analysis of communication circuits including oscillators, radio frequency amplifiers, matching networks, modulators, mixers, and detectors for HF through UHF frequency range using Y- and S- parameter methods. Prerequisite: ECT 350. (F;S;SS)

ITT 675. Video Communication Systems**Credit 3(2-2)**

This course will study the techniques used to transmit and receive analog and digital video information. This course will also discuss current state of the art video technology such as High Definition Television (HDTV). Prerequisite: ECT 350. (F;S;SS)

ITT 680. Radio Wave and Optical Signal Propagation**Credit 3(2-2)**

This courses models the behavior of unguided electromagnetic and optical waves in the atmosphere, space, urban and indoor environments. The course will also discuss path, frequency and antenna selection for practical radio wave communication systems. Prerequisite: ECT 350. (F;S;SS)

ITT 685. Ethical issues in Information Technology**Credit 3(3-0)**

This course explores issues on the interface between information technology and society, with a special focus on ethical issues. Topics include ethical theory, privacy and security, spam, electronic commerce, the digital divide, open source software, medical informatics, bioinformatics, actor-network theory, ethnomethodology, and some neo-classical economics. Prerequisite: Senior Standing (F;S;SS)

Graduate Students Only**ITT 725. Wide Area Networks****Credit 3(3-0)**

This course will examine Wide Area Networks (WANs) and associated media devices and protocols. Also in this course the design, simulation, and implementation of extranet and internet WAN systems will be developed and tested. Prerequisite: Departmental Approval (F;S;SS)

ITT 745. Network Services for the Enterprise**Credit 3(3-0)**

The principles of current wired and wireless services in the telecommunication industry are analyzed for systems and effectiveness. Projected trends and patterns of systems applicable to the industrial communication network will be researched. Prerequisite: Departmental Approval (F;S;SS)

ITT 755. Optical Communication Systems II**Credit 3(2-2)**

This course is a continuation of ECT 655. The course will focus primarily on optical signal processing technologies as they are applied to high-speed communication systems. Prerequisites: ECT 655 (F;S;SS)

ITT 760. Wireless Communication Systems II**Credit 3(2-2)**

The course will discuss the transmission of data over mobile links and digital packet data systems. The course will also address security and privacy issues in wireless communication systems. These topics will be introduced via in-depth case studies of wireless standards such as IS-41, GSM, PCS and third generation standards and technologies. Prerequisites: ECT 650 or ECT 660 (F;S;SS)

ITT 765. Wireless Geo-location Systems II**Credit 3(2-2)**

This course will provide integrated practical examples, in-depth case studies and guidelines for building GPS systems. The course will review in-depth implementation techniques for position location systems. Prerequisites: ECT 665 (F;S;SS)

ITT 770. Communication Circuit Development Laboratory II**Credit 3(1-4)**

This course is a continuation of ECT 670. The course will study practical methods of building a complete high frequency or ultra high frequency communication system at the discrete component level. Prerequisites: ECT 670 (F;S;SS)

Energy and Environmental Studies Ph.D. Program

www.eng.ncat.edu/idp/ees

Keith Schimmel, Interim Director
School of Graduate Studies
Gibbs Hall
(336) 334-7920
schimmel@ncat.edu

OBJECTIVE

The program is designed to prepare men and women for positions in research and consulting in industry, government and service organizations, and teaching and research positions in colleges and universities. Graduates will be able to:

1. Conceive, develop, and conduct original research leading to useful applications in energy and environmental systems.
2. Incorporate into their professional work considerations relating to scientific, technical, managerial, and social aspects of energy and environmental systems.
3. Contribute to societal understanding of global energy and environmental issues including homeland security through development of interdisciplinary educational materials and participation in international exchanges.
4. Demonstrate effective written and oral communication skills related to research issues in energy and environmental systems.

GENERAL PROGRAM ADMISSION REQUIREMENTS

Requirements for admission are:

1. A master's degree in engineering, agriculture, physical, biological and computational sciences, technology, or business and economics from a college or university recognized by a regional or general accrediting agency with a minimum GPA of 3.25/4.0.
2. GRE score of at least 1100.
3. For applicants whose native language is other than English, Test of English as a Foreign Language (TOEFL) examination score of 550 or higher on the written examination or at least 213 on the computer examination.
4. Application for the fall semester completed by April 15 and for the spring semester by October 15.

Students admitted on an unconditional basis are expected to have completed the courses below as part of their prior undergraduate and graduate studies:

Calculus (minimum of 8 semester hours)
Differential Equations
Physics (minimum of 6 semester hours)
Chemistry (minimum of 3 semester hours)
Computer Programming (minimum of 3 semester hours)

Integrated M.S./Ph.D. Program

The integrated M.S./Ph.D. program is to attract outstanding and motivated students into the Ph.D. program. A student with a B.S. degree in a science, engineering, or technology discipline from an accredited program with superior credentials (GPA>3.5, GRE>1200, and strong reference letters) may be admitted to this program. Students in this program are admitted to the Ph.D. program on a provisional basis, but will not be formally admitted to the Ph.D. program until completion of the requirements for a master's degree at NC A&T State University. The admission is therefore a dual admission such that students are accepted into a master's program unconditionally to pursue a M.S. degree and accepted into the Ph.D. program provisionally at the same time. A student in the program must complete their M.S. degree (thesis option) within 24 months with a minimum GPA of 3.3. Up to 6 credit hours of 700-800 level courses may be "double counted" to satisfy both requirements of the M.S. degree and the Ph.D. degree for students in this program. A grade of at least 3.0 is required for a course to be counted toward both degrees.

Co-Major

Students in the Energy and Environmental Studies Ph.D. Program may co-major with other Ph.D. programs offered by NC A&T State University or through the interinstitutional Ph.D. program. This will require the approval of both Ph.D. programs and approval of the student's combined advisory committee. Co-majors must meet all requirements for majors in both programs. Only one degree is awarded and the co-major is noted on the transcript. Co-majors are not permitted between Doctorate-level and lower-level programs.

PROGRAM OPTIONS AND DEGREE REQUIREMENTS

The program requires 51 credit hours beyond the M.S. degree distributed as follows:

27 credit hours for course work,
3 credit hours for seminars,
3 credit hours for professional practice/development,
and 18 credit hours for dissertation research.

Students progress through the program by passing a written qualifying exam over the four core courses and a preliminary exam over the student's proposed research. As an indicator of their research competency, all students will be required to submit at least two refereed journal articles that have been approved by their dissertation committee before graduation. The program requirements are summarized as follows:

Requirement Category	Credits	Courses
Core Courses	12	EES 720, 810, 811*, 820
Written Qualifying Examination	0	EES 991, Covers core courses only
Elective Track	9	Courses at the 700-level or 800-level, Options are presented below
Supervised Teaching/Practicum	3	EES 990 or EES 993
Seminar Requirement	3	<u>EES 992</u>
Technical Electives	6	Courses at the 700-level or 800-level, Subject to advisor approval **
Preliminary Examination	3	<u>EES 995</u>
Dissertation	15	<u>EES 997</u>
TOTAL	51	

*ESE 810 is a prerequisite for ESE 811.

**EES 710 (Theor&Pract of Energy & Env Sci) required as a core course only for students who have not previously had undergraduate or graduate courses in the biological or chemical aspects of energy and environmental science.

Elective Tracks

Biotechnology (ANSC 771, BIOL 700, BIOL 703, BIOL 704, BIOL 706, BIOL 739, BIOL 741, BIOL 749, BIOL 750, BIOL 755, BIOL 780, BIOL 842, BIOL 843, CHEM 756, EASC 718, EES 785, EES 885, HORT 700, PHYS 744, and other courses subject to advisor approval)

Energy and Environmental Education (CUIN 711, CUIN 721, CUIN 729, CUIN 746, ECT 785, EES 785, EES 885, TECH 715, TECH 762, TECH 763, TECH 764, TECH 765, TECH 766, TECH 767, and other courses subject to advisor approval)

Energy and Environmental System Modeling (AGEN 701, AGEN 714, CIEN 702, CIEN 712, CIEN 724, EES 785, EES 885, MATH 712, MATH 721, MATH 723, MATH 731, MATH 733, MATH 752, MATH 765, MATH 781, MEEN 716, MEEN 752, MEEN 860, and other courses subject to advisor approval)

Energy Technologies (ECT 785, EES 785, EES 885, MEEN 838, PHYS 738, PHYS 739, and other courses subject to advisor approval)

Environmental Justice (EASC 708, EES 785, EES 885, and other courses subject to advisor approval)

Environmental Sciences (ANSC 701, BIOL 700, CHEM 711, CHEM 721, CHEM 722, CHEM 723, CHEM 727, CHEM 731, CHEM 732, CHEM 741, CHEM 742, CHEM 743, CHEM 744, CHEM 746, CHEM 748, CHEM 749, CHEM 756, EASC 718, EES 785, EES 885, OSH 704, OSH 706, OSH 731, PHYS 736, PHYS 735, PHYS 738, PHYS 739, PHYS 744, PHYS 745, SLSC 710, SLSC 715, SLSC 717, SLSC 727, SLSC 734, and other courses subject to advisor approval)

Fate and Transport of Contaminants (AGEN 701, AGEN 714, CHEN 710, CHEN 720, CHEN 750, CHEN 760, EASC 718, EES 785, EES 885, MEEN 820, MEEN 822, MEEN 850, SLSC 734, and other courses subject to advisor approval)

Information Technology (ANSC 771, BIOL 706, BIOL 755, BIOL 842, BIOL 843, COMP 710, COMP 711, COMP 712, COMP 713, COMP 732, COMP 740, COMP 755, COMP 770, COMP 785, CSE 702, CSE 703, CSE 704, EES 785, EES 885, ELEN 720, ELEN 821, ELEN 822, MATH 706, MATH 708, MATH 721, MATH 733, MATH 752, MATH 765, and other courses subject to advisor approval)

Materials (CHEN 760, EES 785, EES 885, ELEN 701, ELEN 710, ELEN 801, ELEN 802, ELEN 803, ELEN 804, ELEN 805, ELEN 810, MEEN 752, MEEN 810, MEEN 813, MEEN 820, MEEN 822, MEEN 850, MEEN 860, and other courses subject to advisor approval)

Nanotechnology (CSE711, CSE712, CSE713, EES 785, EES 885, PHYS 735, and other courses subject to advisor approval)

Sensors and Controls (EES 785, EES 885, ELEN 762, ELEN 764, ELEN 861, ELEN 862, ELEN 866, ELEN 867, ELEN 868, ELEN 869, ELEN 870, ELEN 871, INEN 851, INEN 852, MATH 752, and other courses subject to advisor approval)

Separations and Reactions (CHEM 749, CHEN 720, CHEN 750, CHEN 760, EES 785, EES 885, SLSC 734, and other courses subject to advisor approval)

Solid and Hazardous Waste Management (CIEN 710, CIEN 712, EES 785, EES 885, and other courses subject to advisor approval)

Systems Management and Economics (ACCT 714, AREN 770, AREN 778, BUAD 712, BUAD 713, BUAD 715, BUAD 716, BUAD 718, ECT 785, EES 785, EES 885, INEN 721, INEN 731, INEN 734, INEN 821, INEN 822, INEN 832, INEN 833, INEN 843, INEN 844, and other courses subject to advisor approval)

Sustainable Technologies for the Built Environment (AREN 702, AREN 742, AREN 762, AREN 765, AREN 770, AREN 772, AREN 778, EES 785, EES 885, and other courses subject to advisor approval)

Transportation and Logistics (EES 785, EES 885, TRAN 701, TRAN 720, TRAN 725, TRAN 727, TRAN 730, and other courses subject to advisor approval)

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

Initially the Director of the program will serve as the academic advisor for all new students entering the program. Each student in the Ph.D. program is expected to select a major advisor by the beginning of the second year with the approval of the Director. The major advisor must hold a tenure or tenure-track full-time faculty position at the university. However, a co-advisor may have non-tenure-track/adjunct status.

A Ph.D. Advisory Committee will consist of a minimum of four (4) graduate faculty members with the major advisor as its chairperson. Committee members must be from at least two different departments. Also, members must represent more than one campus School/College. The Ph.D. Advisory Committee will be recommended by the major advisor, with input from the student, to the Director of the Ph.D. program, for approval by the Dean of Graduate Studies.

PRELIMINARY EXAMINATION

The dissertation written proposal is submitted to the student's major advisor and the Ph.D. Advisory Committee for review. Dissertation proposals are expected to review the state-of-the-art and should clearly indicate that a substantial literature search has been completed. The proposal must be orally defended by the candidate before the Advisory Committee, and it must be accepted by the committee. The signature of committee members on the dissertation proposal constitutes approval to proceed with research. After receiving a passing grade in the preliminary exam course, EES 995, the student may register for the Energy & Environmental Studies Ph.D. Dissertation course, EES 997.

ADMISSION TO CANDIDACY

Admission to candidacy for the Ph.D. degree in Energy & Environmental Studies will require compliance with the following:

- a) Completion of all core and elective courses approved for the student's program of study,
- b) A minimum cumulative GPA of 3.0 or better, and

c) Successful preliminary examination.

FINAL ORAL EXAMINATION

The final oral examination is scheduled after the dissertation is complete except for such revisions as may be necessary as a result of the examination, but not earlier than one semester or its equivalent after admission to candidacy and not before at least two refereed journal articles have been approved by the advisory committee and are in review by the journals. The examination consists of the candidate's defense of methodology used and the conclusions reached in the research, as reported in the dissertation. It is conducted by the student's advisory committee. A majority vote of approval by the advisory committee is required for passing the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements described by the advisory committee. Failure of a student to pass the examination terminates one's work at this institution unless the advisory committee recommends a reexamination. No reexamination is given until one full semester has elapsed and only one reexamination is permitted.

OTHER INFORMATION

See "Requirements for the Doctor of Philosophy Degree" elsewhere in this catalog for information related to residence requirements, qualifying examination, preliminary examination, final oral examination, admission to candidacy, and time limit. Additional details of requirements for the program are outlined in the Energy and Environmental Studies Ph.D. Program Student Handbook available from the Graduate School.

List of Courses

	Credits
EES 710 Theory and Practice of Energy and Environmental Science	3
EES 720 Theory and Practice of Alternative Energy Technologies	3
EES 785 Special Topics	3
EES 810 Economic and Legal Aspects of Energy and Environmental Management I	3
EES 811 Economic and Legal Aspects of Energy and Environmental Management II	3
EES 820 Acquisition and Management of Energy and Environmental Data	3
EES 885 Special Topics	3

Ph.D. Level Pass/Fail Courses

EES 990 Doctoral Supervised Practicum	3
EES 991 Doctoral Qualifying Examination	0
EES 992 Doctoral Seminar	1
EES 993 Doctoral Supervised Teaching	3
EES 994 Doctoral Supervised Research	3
EES 995 Doctoral Preliminary Examination	3
EES 997 Doctoral Dissertation Var.	3-9
EES 999 Continuation of Doctoral Dissertation	1

COURSE DESCRIPTIONS

- EES-710. Theory and Practice of Energy and Environmental Science** **Credit 3(2-2)**
This course presents both the biological and chemical aspects of energy and environmental science. The biological aspects involve the role of microbes in the environment, remediation processes, and energy production, while the chemical aspects deal with the chemistries of air, water, and soil systems. This is a required course for Energy and Environmental Studies Ph.D. students who do not have a strong background in chemistry or biology. Prerequisite: Graduate standing and consent of instructor.
- EES-720. Theory and Practice of Alternative Energy Technologies** **Credit 3(2-2)**
The course will cover the thermodynamic, mass and energy balance, economic, and environmental considerations of alternative energy technologies. Alternative energy technologies and conventional energy technologies will be compared. This is a required course for Energy and Environmental Studies Ph.D. students.
- EES-785. Special Topics** **Credit 3(3-0)**
This course allows the introduction of new courses on a trial basis or special content courses on a one time basis at the master's level. The topic and title of the course are determined prior to registration.
- EES-810. Economic and Legal Aspects of Energy and Environmental Management I** **Credit 3(3-0)**
This course is a study of economic and legal concepts that affect the decision-making process in the management of energy and the environment. Policy case studies are used to allow a variety of perspectives to be examined. This is a required course for Energy and Environmental Studies Ph.D. students.
- EES-811. Economic and Legal Aspects of Energy and Environmental Management II** **Credit 3(3-0)**
This course is a continuation of EES 810. This is a required course for Energy and Environmental Studies Ph.D. students.
- EES-820. Acquisition and Management of Energy and Environmental Data** **Credit 3(2-2)**
This course is a study of theories and techniques for acquiring and managing scientific data and information related to the analysis, design, and management of energy and environmental systems. This is a required course for Energy and Environmental Studies Ph.D. students.
- EES-885. Special Topics** **Credit 3(3-0)**
This course allows the introduction of new courses on a trial basis or special content courses on a one time basis at the doctoral level. The topic and title of the course are determined prior to registration.
- EES-990. Doctoral Supervised Practicum** **Credit 3(0-6)**
This course represents the supervised internship for the doctoral student that satisfies the 3 credits of required professional development. Oral and written presentations on the experience will be provided to the Energy and Environmental Studies program director. Grading is pass/fail evaluation only.
- EES-991. Doctoral Qualifying Examination** **Credit 0(0-0)**
This course will guide the student to take the qualifying examination. The qualifying examination will consist of a written examination over the Energy and Environmental Studies program core courses.
- EES-992. Doctoral Seminar** **Credit 1(1-0)**
This course includes presentations delivered by the doctoral student, faculty, and invited speakers. Each registered student will make at least one seminar presentation and provide at least one formal critique of a presentation. Three credits of seminar are required for graduation. Grading is pass/fail evaluation only.
- EES-993. Doctoral Supervised Teaching** **Credit 3(1-3)**
This course represents the supervised teaching for the doctoral student that satisfies the 3 credits of required professional development. This course introduces the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Doctoral students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Grading is pass/fail evaluation only.

EES-994. Doctoral Supervised Research

Credit 3(3-0)

This course is supervised research under the mentorship of a member of the graduate faculty before a student passes the preliminary exam. This research should lead to the identification of a dissertation topic and written research proposal. Grading is pass/fail evaluation only

EES-995. Doctoral Preliminary Examination

Credit 3(3-0)

In this course dissertation advisors will guide their students towards completing the preliminary examination. The preliminary examination will consist of a written proposal and oral defense of the student's dissertation proposal. Grading is pass/fail evaluation only.

EES-997. Doctoral Dissertation Variable

Credit 3(3-9)

This course represents the supervised research leading to the dissertation for the doctoral student who has passed the preliminary exam. Doctoral dissertation research will be conducted under the supervision of the dissertation committee chairperson and include regular meetings with the dissertation committee to evaluate progress on the dissertation. Grading is pass/fail evaluation only.

EES-999. Continuation of Doctoral Dissertation

Credit 1(1-0)

This course is a continuation of EES 997. The course is for doctoral students who have completed all required credit hour requirements. Grading is pass/fail evaluation only.

English

<http://www.ncat.edu/~english/>

Shirley H. Bell, Interim Chairperson
426-A New Classroom Building
(336) 334-7771 or (336) 334-7772

OBJECTIVE

The objective of the English Department is to provide in-depth training in English Education; English, American, and African American literature; folklore; and language.

DEGREES OFFERED

Master of Arts Degree - English and African American Literature
Master of Science Degree - English Education

REQUIREMENTS FOR ADMISSION TO THE M.A. PROGRAM IN ENGLISH AND AFRICAN AMERICAN LITERATURE AND THE M.S. PROGRAM IN ENGLISH EDUCATION

All applicants to the M.A. and M.S. programs must have earned a bachelor's degree from a four-year college. Applicants must also have completed a minimum of twenty-four (24) undergraduate hours in English. The hours must include at least three semester hours of Shakespeare, three of American literature, three of English literature, three of world literature or contemporary literature, three of advanced grammar, and three of advanced composition.

A student who fails to meet these qualifications will be expected to satisfy the requirements by enrolling in undergraduate courses before beginning graduate studies in English. Scores for the GRE general test must be submitted for consideration as a part of the admission process.

Application forms may be obtained from the office of the Graduate School and are also available on-line at the A&T Web-site. Application forms must be completed and returned to the Graduate School Office. Two (2) official transcripts of previous undergraduate or graduate records and three (3) letters of recommendation must be forwarded to the Graduate Office before action can be taken on the application. An applicant may be admitted to the program unconditionally, provisionally, or as a special student.

Unconditional Admission. To qualify for unconditional admission to the programs, an applicant must have earned an overall average of 3.0 on a four-point system (or 2.0 on a three point system) in undergraduate studies.

Provisional Admission. An applicant may be admitted to graduate studies on a provisional basis if (1) the record of undergraduate preparation reveals deficiencies that can be removed near the beginning of graduate study, or if (2) the applicant lacks the required grade point average for unconditional admission. The applicant may then become eligible for unconditional admission by successfully completing the first nine (9) hours of course work with a 3.0 or better average. Students admitted provisionally may also be required to pass examinations to demonstrate their knowledge in certain areas or to take special undergraduate courses to improve their background. A minimum grade point average of 2.6 in undergraduate work is required for provisional admission.

Special Students. Students not seeking the M.A. or M.S. degree may be admitted in order to take courses for self-improvement or for renewal of teaching certificates. If the student subsequently wishes to pursue the M.A. or M.S. program, he or she must request an evaluation of the work. Under no circumstances may the student apply toward a degree program more than twelve (12) hours earned as a special student.

M.A. AND M.S. DEGREE REQUIREMENTS

Total Hours Required. The M.A. and M.S. programs consist of two distinct but similar elements. For the M.A. program, the student may elect to take twenty-seven (27) hours of course work and write a thesis for three (3) hours credit in order to satisfy the thirty-hour minimum requirement. The student may also elect not to write a thesis and take an additional three (3) hours of course work in order to satisfy the thirty-hour minimum requirement. For the M.S. program, the student may elect to take thirty-six (36) hours of course work and write a thesis for three (3) hours credit in order to satisfy the requirement of thirty-nine (39) total hours. The student may also elect not to write a thesis and take an additional three (3) hours of course work in order to satisfy the requirement of thirty-nine (39) hours.

For the M.A. program, three specific English courses are required: ENGL 700 – Introduction to Critical Theory; ENGL 753 – Introduction to Graduate Literary Studies; and ENGL 755 - Contemporary Practices in Grammar and Rhetoric. In addition, the student must take twelve (12) hours in African American Literature and nine (9) hours in English and American Literature. (The student who elects the thesis option is required to take only nine (9) hours in African-American Literature.)

For the M.S. program, four specific English courses are required: ENGL 700 – Introduction to Critical Theory; ENGL 730 - Directed Study in English; ENGL 753 – Introduction to Graduate Literary Studies; and ENGL 755 - Contemporary Practices in Grammar and Rhetoric. In addition, five specific courses in Curriculum and Instruction are required: CUIN 619 – Learning Theories; CUIN 711- Research and Inquiry; CUIN 721 - Advanced Methods; CUIN 728 - Technology in K-12 Schools; and CUIN 729 - Diversity Issues in K-12 Schools. Courses at the 700 level (and ENGL 699) are open only to graduate students. For students in both programs, fifty percent of their course work must be at the 700 level. Therefore, students enrolled in the M.A. program must complete fifteen (15) hours of course work at the 700 level. Students in the M.S. program satisfy this requirement automatically because eight (8) of their required courses, totaling twenty-four (24) hours, are at the 700 level. (Students may apply 700 level professional education courses toward meeting this requirement.) All 600 level courses (except for ENGL 699) are open both to senior undergraduate students and to graduate students.

Grades Required. Students in the programs must maintain at least a 3.0 grade point average in order to satisfy the grade requirements of the program. If a student receives a C or lower in more than two (2) courses, he or she will be dropped from the program.

Amount of Credit Accepted for Transfer. The Graduate School will accept six (6) semester hours of transfer credit from another institution for those students enrolled in degree programs.

Other Requirements (Comprehensive and Thesis Examinations). For the M.A. and M.S. degrees, students must pass a three (3) hour written comprehensive examination administered by the English Department. The comprehensive examination will cover only material to which the student has been exposed in course work at A&T. The comprehensive examination may be taken twice. An additional comprehensive examination in education is required of persons pursuing the M.S. degree. Those students who elect to write a thesis must meet the deadlines projected by the Graduate School in addition to standing for a one-hour oral examination which constitutes a defense of the thesis. The defense may be attempted twice.

CAREER OPPORTUNITIES

Both the M.A. and M.S. degrees prepare students to pursue graduate study for the doctorate in English and related fields. The M.S. prepares students to teach on the secondary and college levels. The M.A. degree is designed primarily to prepare students for college teaching and for admission to doctoral programs.

CURRICULUM GUIDE FOR M.A. DEGREE IN ENGLISH AND AFRICAN AMERICAN LITERATURE

Non-Thesis Option: 30 semester hours required

1. Required: ENGL 700, 753, 755
2. Twelve (12) hrs. from the following: ENGL 631, 650, 652, 653, 654, 656, 658, 660, 744, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 628, 631, 653, 672, 699, 701, 703, 704, 705, 706, 707, 712, 721, 722, 723, 724, 730, 731, 744

Thesis Option: 30 semester hours required

1. Required: ENGL 700, 753, 755
2. Nine (9) hrs. from the following: ENGL 631, 650, 652, 653, 654, 656, 658, 660, 744, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 628, 631, 653, 672, 699, 701, 703, 704, 705, 706, 707, 712, 721, 722, 723, 724, 730, 731, 744
4. Thesis Research: ENGL 775 (3 semester hours)

CURRICULUM GUIDE FOR M.S. DEGREE IN ENGLISH EDUCATION

Non-Thesis Option: *39 semester hours required*

1. Required: ENGL 700, 730, 753, 755
2. Required: CUIN 619, 711, 721, 728, 729
3. One African American Literature course from the following: ENGL 631, 650, 652, 653, 654, 656, 658, 660, 744, 760, 762, 764, 766
4. One American Literature course from the following: ENGL 628, 631, 653, 672, 721, 722, 723, 724, 744
5. One British Literature course from the following: ENGL 699, 701, 703, 704, 705, 706, 707
6. One additional three-hour course in African-American, American, or British Literature from courses listed in numbers 3, 4, and 5.

Thesis Option: *39 semester hours required*

1. Required: ENGL 700, 730, 753, 755
2. Required: CUIN 619, 711, 721, 728, 729
3. One African American Literature course from the following: ENGL 631, 650, 652, 653, 654, 656, 658, 660, 744, 760, 762, 764, 766
4. One American Literature course from the following: ENGL 628, 631, 653, 672, 721, 722, 723, 724, 744
5. One British Literature course from the following: ENGL 699, 701, 703, 704, 705, 706, 707
6. Thesis Research: ENGL 775 (3 semester hours)

Courses for Senior Undergraduates and for Graduates

ENGL 600	Language Variations in American English
ENGL 603	Introduction to Folklore
ENGL 626	Children's Literature
ENGL 627	Literature for Adolescents
ENGL 628	The American Novel
ENGL 631	Black Women Writers of Africa and the Diaspora
ENGL 650	African American Folklore
ENGL 652	African American Drama
ENGL 653	Teaching English as a Second Language
ENGL 654	African American Novel I
ENGL 656	African American Novel II
ENGL 658	African American Poetry I
ENGL 660	African American Poetry II
ENGL 672	Directed Study in English

Graduate Courses: Open Only to Graduate Students

ENGL 699	Medieval Literature
ENGL 700	Introduction to Critical Theory
ENGL 701	English Renaissance Literature
ENGL 703	Seventeenth-Century English Literature
ENGL 704	Eighteenth-Century English Literature
ENGL 705	Romantic Literature
ENGL 706	Victorian Literature
ENGL 707	Modern British Fiction

ENGL 710	Language Arts for Elementary Teachers I
ENGL 711	Language Arts for Elementary Teachers II
ENGL 712	Teaching of Freshman Writing
ENGL 721	Major American Writers I
ENGL 722	Major American Writers II
ENGL 723	Modern American Poetry
ENGL 724	American Multi-Cultural Literature
ENGL 730	Directed Study in English
ENGL 731	Technology in Teaching and Research in the Humanities
ENGL 744	Postcolonial Novel and Theory
ENGL 753	Introduction to Graduate Literary Studies
ENGL 754	History and Structure of the English Language
ENGL 755	Contemporary Practices in Grammar and Rhetoric
ENGL 760	Non-Fiction by African American Writers
ENGL 762	Short Fiction by African American Writers
ENGL 764	African American Aesthetics
ENGL 766	Seminar in African American Literature and Language
ENGL 770	Seminar
ENGL 775	Thesis Research

ENGLISH COURSE DESCRIPTIONS
Advanced Undergraduate and Graduate Courses

ENGL 600. Language Variations in American English **Credit 3 (3-0)**

This course is a survey of regional and social dialects in the United States and a study of their interrelationship; it provides examples of some of the motivations for dialectical divergences, especially in the instance of non-standard dialects, and a consideration of functional varieties and social dialect shifting. Prerequisite: English 310 or graduate standing. (Demand)

ENGL 603. Introduction to Folklore **Credit 3(3-0)**

This course is a basic introduction to the study and appreciation of folklore. (Cross-listed as Anthropology 603). (Summer/alternate years)

ENGL 626. Children's Literature **Credit 3 (3-0)**

This course is a study of the types of literature designed especially for students in elementary, intermediate, and middle schools. Prerequisites: English 101, Humanities 200-201. (Fall; Spring; Summer)

ENGL 627. Literature for Adolescents **Credit 3 (3-0)**

This course acquaints prospective and in-service teachers with a wide variety of good literature that is of interest to adolescents. Emphases are on thematic approach to the study of literature, book selection, and motivation of students to read widely and independently with depth and understanding. Prerequisite: English 101, 200, and 201 or graduate standing. (Fall)

ENGL 628. The American Novel **Credit 3 (3-0)**

This course is a history of the American novel from Cooper to Faulkner; Melville, Twain, Howells, James, Dreiser, Lewis, Hawthorne, Faulkner, and Hemingway will be included. Prerequisite: English 210. (Demand)

ENGL 631. Black Women Writers of Africa and the Diaspora **Credit 3 (3-0)**

This course examines literary texts by black women globally, including Africa, America, the Caribbean, and Europe, with a view to understanding, among other things, issues they share in common. (Fall, Spring, Summer)

ENGL 650. African American Folklore **Credit 3 (3-0)**

This course studies folk tales, ballads, riddles, proverbs, superstitions, and folk songs of African Americans. Parallels will be drawn between folklore peculiar to African-Americans and that of Africa, the Caribbean, and other nationalities. (Spring)

ENGL 652. African American Drama **Credit 3 (3-0)**

This course is a detailed study of the dramatic theory and practice of African American writers against the backdrop of Continental and American trends. Special attention will be given to the works of major figures from the Harlem Renaissance to the present. Works by Bontemps, Cullen, Hughes, Hansberry, Ward, Davis, Baldwin, Baraka (Jones), Gordone, and Bullins will be included. (Demand)

ENGL 653. Teaching English as a Second Language **Credit 3 (3-0)**

This course introduces prospective secondary and college teachers of students learning English as a second and/or a foreign language to various pedagogical approaches. The course will explore theories and practices aimed at second language acquisition involving reading and writing. (Fall, Spring, Summer)

ENGL 654. African American Novel I **Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretative study of novels by major African American writers through 1940. Novelists emphasized include Dunbar, Chesnutt, Toomer, McKay, Larsen, Hurston, Fauset, and Wright. (Fall)

ENGL 656. African American Novel II **Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretative study of novels by major African American writers after 1940. Novelists emphasized include Wright, Ellison, Baldwin, Himes, Demby, Williams, Walker, Brooks, Petry, Gaines, and Mayfield. (Spring)

ENGL 658. African American Poetry I **Credit 3 (3-0)**

This course is an intensive study of African American poetry from its beginning to 1940, with special attention given to poets of the Harlem Renaissance. Poets to be studied include Terry, Hammon, Wheatley, A.A. Whitman, Horton, Braithwaite, J.W. Johnson, Horne, Fenton Johnson, Georgia Douglas Johnson, McKay, Cullen, Cuney, and Hughes. (Demand)

ENGL 660. African American Poetry II **Credit 3 (3-0)**

This course is an intensive study of African American poetry from 1940 to the present with considerable attention given to the revolutionary poets of the sixties and seventies. Poets to be studied include Hughes, Walker, F.M. Davis, Brooks, Brown, Hayden, Tolson, Lee, Reed, Giovanni, Angelou, Jeffers, Sanchez, Redmond, Fabio, Fields, and Baraka. (Fall)

ENGL 672. Directed Study in English **Credit 3 (3-0)**

This course provides an opportunity for students to pursue independent and in-depth study in literature, linguistics, or professional writing. Work done in literature for this course may serve as groundwork for students pursuing the thesis option. Prerequisite: Advanced undergraduate or graduate standing and prior consultation with departmental faculty.

Graduate Students Only

ENGL 699. Medieval Literature **Credit 3 (3-0)**

This course is a study of the major English writers of the Middle Ages, including Chaucer, Malory, Langland, the "Gawain" poet, the "Everyman" playwright, and various other writers in the dramatic, religious, lyric, and ballad traditions. (Fall/alternate years)

ENGL 700. Introduction to Critical Theory **Credit 3 (3-0)**

This course outlines and critiques major movements in contemporary literary theory, including, for example, Marxism, feminism, and various poststructuralisms. (Fall)

ENGL 701. English Renaissance Literature **Credit (3-0)**

This course is a study of major prose and poetry, both dramatic and non-dramatic, of the English Renaissance. Writers to be studied include More, Sidney, Spenser, Marlowe, and Shakespeare. (Fall/alternate years)

ENGL 703. Seventeenth-Century English Literature **Credit 3 (3-0)**

This course is a study of major prose and poetry, both dramatic and non-dramatic, of Seventeenth-Century English. Writers to be studied include Jonson, Donne, Bacon, Webster, Marvell, Milton, and Dryden. (Summer/alternate years)

ENGL 704. Eighteenth-Century English Literature **Credit 3 (3-0)**

This course is a study of the major prose and poetry writers of the Eighteenth Century in relation to the cultural and literary trends. Dryden, Defoe, Swift, Fielding, Addison, Pope, Johnson, and Blake will be included. (Demand)

ENGL 705. Romantic Literature **Credit 3 (3-0)**

This course is a study of English Romantic writers. Blake, Wordsworth, Coleridge, Keats, Shelley, Byron, Hazlitt, DeQuincey, and Lamb will be included. (Spring/alternate years)

ENGL 706. Victorian Literature **Credit 3 (3-0)**

This course is a study of Nineteenth-Century Victorian writing, including poetry, fiction, and non-fictional prose. Writers to be considered will include Tennyson, Browning, Arnold, the Rossettis, Carlyle, Mill, Dickens, the Brontes, Eliot, Thackeray, and Hardy. (Spring/alternate years)

ENGL 707. Modern British Fiction **Credit 3 (3-0)**

This course is a study of English and Irish writers from the beginning of the Twentieth Century to the present. Authors to be considered include Joyce, Woolf, Forster, Lawrence, Mansfield, and Lessing. (Summer/alternate years)

ENGL 710. Language Arts for Elementary Teachers I **Credit 3 (3-0)**

This course is designed to provide elementary school teachers with an opportunity to discuss problems related to the language arts taught in the elementary school. (Not accepted for credit towards concentration in English.) (Summer/alternate years)

ENGL 711. Language Arts for Elementary Teachers II **Credit 3 (3-0)**

This course is a continuation of the study of relevant language situations with which elementary teachers should be concerned. Emphases will be placed on strategies for guiding pupils to explore the nature and structure of language and for teaching essential language skills. (Not accepted for credit towards concentration in English.) (Summer/alternate years)

ENGL 712. Teaching of Freshman Writing **Credit 3 (3-0)**

This course is required of all English graduate teaching assistants (GTAs), and is designed solely to provide an academic setting for the theoretical and practical components of teaching English 100. GTAs will discuss and implement writing assignments, exercises in literature and grammar, and the methods of leading class discussion. (Fall)

ENGL 721. Major American Writers I **Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretive study of works by major American writers through 1900. Writers to be discussed will vary and will include Emerson, Fuller, Thoreau, Poe, Hawthorne, Clemens, Whitman, Melville, Dickinson, and James, among several others. (Fall)

ENGL 722. Major American Writers II **Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretive study of works by major American writers from 1900 to the present. Writers to be discussed will vary and will include Stein, Eliot, Hemingway, Faulkner, Toomer, Hurston, Frost, Oates, and Morrison, among several others. (Spring)

ENGL 723. Modern American Poetry **Credit 3 (3-0)**

This course is an intensive study of Twentieth-Century American poetry. Special attention will be given to major movements, definitions of modernism, and individual poets. Authors to be considered include Frost, Eliot, Moore, Hughes, Williams, Brooks, and Dove. (Summer)

ENGL 724. American Multi-Cultural Literature **Credit 3 (3-0)**

This course will examine the critical and historical perspectives of selected works by Native American, Asian American, and Hispanic (including American Chicano, Latino, and Puerto Rican) authors. Writers to be studied include Black Elk, Paula Gunn Allen, Joy Harjo, Louise

Erdrich, N. Scott Momaday, Simon Ortiz, Leslie Marmon Silko, James Welch, Maxine Hong Kingston, Frank Chin, Amy Tan, Jose Garcia Villa, Rudolfo Anaya, Pat Mora, Tomas Rivera, Gary Soto, Victor Cruz Hernandez, and Sandra Cisneros. (Summer)

ENGL 730. Directed Study in English **Credit 3 (3-0)**

This course provides an opportunity for students to pursue in-depth study in literary criticism, literature, linguistics, or writing. Also, work done in this course may serve as groundwork for students pursuing the thesis option, developing a portfolio, or acquiring practicum experience. Repeatable once upon approval of departmental chair and/or coordinator of graduate studies in English. Prerequisite: approval of, and prior consultation with, instructor. (Fall, Spring, Summer)

ENGL 731. Technology in Teaching and Research in the Humanities **Credit 3 (3-0)**

This course offers students the opportunity to develop and apply advanced technology in the areas of teaching and/or research in the humanities. Applications include the following: virtual reality, hypertext, hypermedia, distance learning, web-enhanced teaching, advanced research techniques, and hypertext bibliographies. Prerequisite: approval of instructor. (Spring)

ENGL 744. Postcolonial Novel and Theory **Credit 3 (3-0)**

This course examines postcolonial theory and its application to both postcolonial (including the Caribbean, Latin America, Africa, the Middle East, the Balkans, the former republics of the Soviet Union, India, Asia, and Oceania) novels and contemporary society, whether local, national, or global. (Fall, Spring, Summer)

ENGL 753. Introduction to Graduate Literary Studies **Credit 3 (3-0)**

This course introduces the central research practices of contemporary literary scholarship and their purposes and helps students to design individual research projects and acquire the tools necessary to bring them to fruition. (Fall)

ENGL 754. History and Structure of the English Language **Credit 3 (3-0)**

This course is a study of the changes in the English language — syntax, vocabulary, spelling, pronunciation, and usage — from the Fourteenth century through the Twentieth century. (Demand)

ENGL 755. Contemporary Practices in Grammar and Rhetoric **Credit 3 (3-0)**

This course is designed to provide secondary teachers of English with experience in linguistics applied to modern grammar and composition. (Spring)

ENGL 760. Non-Fiction by African American Writers **Credit 3 (3-0)**

This course studies non-fiction by African American writers, including slave narratives, autobiographies, biographies, essays, letters, and orations. (Demand)

ENGL 762. Short Fiction by African American Writers **Credit 3 (3-0)**

This course is an intensive examination of short fiction by African American writers. Among those included are Chesnutt, Dunbar, Toomer, Hurston, McKay, Hughes, Bontemps, Wright, Clarke, Ellison, Fair, Alice Walker, Ron Milner, Julia Fields, Jean W. Smith, Petry, Baldwin, Kelley, and Baraka. (Spring/alternate years)

ENGL 764. African American Aesthetics **Credit 3 (3-0)**

This course defines those qualities of African American literature that distinguish it from traditional American literature through an analysis of theme, form, and technique as they appear in a representative sample of works by African-American writers. (Demand)

ENGL 766. Seminar in African American Literature and Language **Credit 3 (3-0)**

This is a topics course that will vary; focus will be on prominent themes and/or subjects treated by African American writers from the beginning to the present. An attempt will be made to characterize systematically the idiom (modes of expression, style) of African-American writers. (Demand)

ENGL 770. Seminar

Credit 3 (3-0)

This course provides an opportunity for presentation and discussion of a thesis, as well as selected library or original research projects from non-thesis candidates. Prerequisite: 15 hours of graduate-level courses in English. (Demand)

ENGL 775. Thesis Research (Demand)

Credit 3 (3-0)

Graphic Communication Systems and Technological Studies

Cynthia C. Gillispie-Johnson, Chairperson
116 Price Hall
(336) 334-7550
<http://www.ncat.edu/~gcsts/>

OVERVIEW

The Master of Science in Technology Education with concentrations in Technology Education, Teaching; Trade and Industrial Education, Teaching; Workforce Development Director; OR Training and Development for Industry provide experiences with advanced concepts, technologies, research, and strategies for the preparation of teacher/practitioners. This program complies with INTASC, NCATE, DPI, and National Board Certification standards. This program will prepare graduate students to provide instructional leadership and to capably deliver technology education to the public schools and to business and industry of North Carolina.

OBJECTIVES

1. To develop advanced competencies in organizing and utilizing technology education strategies and methods.
2. To further develop understanding and application of objectives, principles, concepts, practices, and philosophies of technology education.
3. To further develop competencies in organizing, directing, and evaluating technology education programs, courses, and teaching-learning activities.
4. To develop proficiency in utilizing technological-educational problem solving and research techniques in technology education programs.
5. To further develop depth and/or breadth in technological competencies in the various fields of technology education.

DEGREES OFFERED

Master of Science - Technology Education

**Concentrations: Technology Education, Teaching
Trade and Industrial Education, Teaching
Workforce Development Director
Training and Development for Industry**

GENERAL PROGRAM REQUIREMENTS

Admission Criteria

Criteria for admission are GRE or MAT scores and an undergraduate GPA of 2.5 or better. It is the responsibility of the candidate to meet these requirements as well as any other requirements of the School of Graduate Studies.

Non-Licensure Students

The Class A license is not required for the concentration Training and Development for Industry.

Licensure Only Students

Candidates who are admitted to graduate studies as licensure only students can not be admitted to the Graduate Program until Class A licensure is obtained. After the Class A certificate is obtained; application for admission to the graduate program may be pursued.

DEPARTMENTAL REQUIREMENTS

Master's degree candidates must complete a minimum of 39 semester hours of graduate level courses, which include: 12 semester hours of professional education courses; 15 semester hours of required courses in the thesis or non-thesis option; and 12-semester hours in one

of four concentrations: Technology Education, Teaching; Trade and Industrial Education, Teaching; Workforce Development Director or Training and Development for Industry. The two Teaching concentrations may lead to Advanced Licensure. The grade point average in the graduate program must be 3.0 or better.

All majors must pass a Products of Teaching Portfolio due the last full month of the semester in which the student graduates. The portfolio must meet the requirements of the North Carolina State Department of Public Instruction's performance based licensure. TECH 717 or TECH 718 helps the student to establish the portfolio.

It is the student's responsibility to enroll in TECH 788, Comprehensive Final Exam, in the semester he or she intends to graduate.

It is the student's responsibility to APPLY FOR GRADUATION through the School of Graduate Studies before the deadline posted on the University Calendar in the semester he or she intends to graduate.

The student must be enrolled the semester he or she plans to graduate.

The student must be continuously enrolled until the student graduate, and the student must complete the degree within 6 years.

At least fifty percent of the courses counted towards the degree must be numbered 700 and above.

Trade and Industrial Education, Teaching Concentration majors (who lack a continuing license in Trade and Industrial Education) may be required to complete up to 600 hours of internship in industry in the area of technical specialty if they lack at least that amount of relevant, verifiable work experience in the specialty area. This is in addition to the courses posted on the program of study. However, this internship may be applied toward two electives in the Concentration Courses section of the program of study.

Documentation of Approvals: (1) Comprehensive Examination passed, (2) Completion of Research Project and (3) Completion of Comprehensive Portfolio

The Curriculum Guide outlines the sequence of required courses and the benchmarks. A copy of this guide will be kept in the student's folder in the advisor's office to be updated at each advising conference. Advising conferences must be arranged by the candidate prior to registration for the next semester.

CAREER OPPORTUNITIES

Excellent employment opportunities exist for persons holding advanced degrees in all areas of Technology Education. Public schools in North Carolina and elsewhere are in constant need of securing licensed teachers, supervisors, and administrators for technology programs. Many career opportunities also exist for Technology Education specialists in occupations that do not require state teacher licensure. These persons are employed as teachers, training directors, supervisors and managers in post-secondary schools and colleges or in the private sector of industry.

Paradigm for Master of Science for Technology Education

**Concentrations: Technology Education, Teaching
Trade and Industrial Education, Teaching
Workforce Development Director
Training and Development for Industry**

Professional Education Courses

CUIN 619	Learning Theories	3 sh
CUIN 721	Advanced Methods	3 sh
CUIN 729	Diversity Issues in Public Schools	3 sh
CUIN 743 or CUIN 766	Foundations or Instr. Tech. or Distance Ed.	<u>3 sh</u>
	sub total	12 sh

Required courses for Thesis Option

TECH 672	Curriculum Development in Technological Education	3 sh
TECH 762	Evaluation of Technological Education Programs	3 sh
TECH 767	Research and Literature in Technological Education	3 sh
TECH 768	Technological Seminar (abide by university deadlines for the thesis)	3 sh
TECH 769	Thesis Research (abide by university deadlines)	3 sh
TECH 788	Comprehensive Final Examination (take the last semester; date announced in class)	<u>0 sh</u>

All students must apply for graduation by the deadline in their last semester.

All students must turn in their portfolios by the last full month of their last semester.

sub total 15 sh

OR

Required courses for Non-thesis Option

TECH 672	Curriculum Development in Technological Education	3 sh
TECH 762	Evaluation of Technological Education Programs	3 sh
TECH 767	Research and Literature in Technological Education	3 sh
TECH 717/718	Special Problems I/II	3 sh
TECH 768	Technological Seminar	3 sh
TECH 788	Comprehensive Final Examination (take the last semester; date announced in class)	<u>0 sh</u>

All students must apply for graduation by the deadline in their last semester.

All students must turn in their portfolios by the last full month of their last semester.

sub total 15 sh

Concentration in Technology Education, Teaching

(Select 12 semester hours from the following list. Each course in the list is 3 semester hours.)

TECH 608	Study of Technology
TECH 617	Introduction to Coordination of Industry and Education Partnerships
TECH 618	Technological Education for Special Needs Students
TECH 619	Construction Systems for Technological Education
TECH 620	Manufacturing Systems for Technological Education
TECH 621	Communication Systems for Technological Education
TECH 622	Transportation Systems for Technological Education
TECH 623	Research and Development in Technological Education
TECH 626	Curriculum Modification in Technological Education for Special Needs Population
TECH 664	Occupational Exploration for Middle Grades
TECH 665	Middle Grades Industrial Laboratory
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 682	Computer Applications for Education and Industrial Training
TECH 715	Advanced Research and Development Practices for Technological Education
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 731	Advanced Graphic Techniques
TECH 763	Technological Education for Elementary Grades
TECH 770	Systematic Design of Training and Development Programs
GCS 630	Multimedia and Videography
GCS 631	Advanced Computer Aided Design
GCS 632	Graphic Animation
GCS 634	Advanced Multimedia and Videography
GCS 635	Advanced Principles of Graphic Communications Technology
GCS 636	Electronic Imaging and Distance learning
GCS 670	Electronic Imaging and Graphic Communication
GCS 719	Seminar in Computer Aided Drafting and Design
GCS 733	Graphic Communication Systems Organization and Management

Concentration in Trade and Industrial Education, Teaching

(Select 12 semester hours from the following list. Each course in the list is 3 semester hours.)

GCS 601	Advanced Flexography Methods
GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
GCS 630	Multimedia and Videography
GCS 631	Advanced Computer Aided Design
GCS 632	Graphic Animation
GCS 633	Advanced Machine Design and Drafting
GCS 634	Advanced Multimedia and Videography
GCS 635	Advanced Principles of Graphic Communications Technology
GCS 636	Electronic Imaging and Distance Learning
GCS 644	Advanced Architectural Drafting and Design
GCS 670	Electronic Imaging and Graphic Communication
GCS 719	Seminar in Computer Aided Drafting and Design
GCS 731	Advanced Graphic Techniques
GCS 733	Graphic Communication Systems Organization and Management
TECH 660	Career Development and Work-based Learning
TECH 661	Workforce Development Program Planning and Management
TECH 663	History and Philosophy of Technological Education
TECH 664	Occupational Exploration for Middle Grades
TECH 665	Middle Grades Industrial Laboratory
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 670	Introduction to Workplace Training and Development
TECH 671	Methods and Techniques of Workplace Training and Development
TECH 682	Computer Applications for Education and Industrial Training
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 770	Systematic Design of Training and Development Programs
CUIN 605	Concepts in Career Education

Concentration in Workforce Development Director

(Select 12 semester hours from the following list. Each course in the list is 3 semester hours.)

GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
GCS 719	Seminar in Computer Aided Drafting and Design
TECH 660	Career Development and Work-based Learning
TECH 661	Workforce Development Program Planning and Management
TECH 663	History and Philosophy of Technological Education
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 764	Administration and Supervision of Technological Education
ADED 773	Leadership
CUIN 612	Instructional Design
CUIN 709	Administration and Supervision
CUIN 723	Principles of Teaching

Concentration in Training and Development for Industry

(Select 12 semester hours from the following list. Each course in the list is 3 semester hours.)

GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
TECH 663	History and Philosophy of Technological Education
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 670	Introduction to Workplace Training and Development

TECH 671	Methods and Techniques of Workplace Training and Development
TECH 682	Computer Applications for Education and Industrial Training
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 764	Administration and Supervision of Technological Education
TECH 766	Curriculum Laboratories in Industrial Settings
TECH 770	Systematic Design of Training and Development Programs
ADED 714	The Community College and Post-secondary Education
ADED 773	Leadership
ADED 776	Principles of College Teaching
ADED 777	Seminar in Higher Education
ADED 778	Student Personnel Services
ADED 779	Technical Education in Community Colleges

TOTAL: 39

Note: GCS 667 Independent Studies in Technological Education I and GCS 668 Independent Studies in Technological Education II may be substituted for selected courses with consent of advisor.

COURSES WITH DESCRIPTION IN GRAPHIC COMMUNICATION SYSTEMS AND TECHNOLOGICAL STUDIES Advanced Undergraduate and Graduate

GCS-601. Advanced Flexographic Methods Credit 3 (2-2)

This course is designed to develop advanced proficiency in flexographic printing. It includes the prediction of future flexographic markets, products, substrates, inks, solvents, and industry standards for color processing.

TECH-608. Study of Technology Credit 3 (2-2)

This course emphasizes contemporary methods of developing problem solving skills through the four technologically adaptive systems (communications, construction, manufacturing, transportation), mathematics and science.

TECH-610. Internship in Industry I Credit 3 (0-7)

Students participate in an industrial setting during a semester in their major field of interest. They will be evaluated during the internship and keep a field diary of events and experiences. Three semester hours is the maximum hours to be earned during a semester

TECH-611. Internship in Industry II Credit 3 (0-7)

Students participate in an industrial setting during a semester in their major field of interest. They will be evaluated on reports from industry and a field diary of events and experiences. Three semester hours is the maximum hours to be earned during a semester.

TECH-617. Introduction to Coordination of Industry and Education Partnerships Credit 3 (3-0)

This course examines the interrelationship, organizational structure, and logistics of industry and education partnerships. Topics include establishing guidelines, developing networks, coordinating personnel, supervising participants, and evaluating performance.

TECH-618. Technological Education for Special Needs Students Credit 3 (3-0)

Opportunities are provided for teachers, counselors, and administrators to improve their skills in working with disadvantaged/handicapped learners in technological education. Emphasis will be placed on motivational and creative instructional strategies, discipline, drug awareness, and module development.

TECH-619. Construction Systems for Technological Education Credit 3 (2-2)

The evolution of construction and construction systems on human and societal development will be discussed. Teaching strategies regarding construction systems including design, engineering, site preparation, foundations, superstructure, mechanical systems, and clearing and

finishing the structure will be studied. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

TECH-620. Manufacturing Systems for Technological Education **Credit 3 (2-2)**

This course will cover the organization, product design, and production systems associated with manufacturing. It will emphasize teaching strategies and curriculum development in relation to manufacturing systems. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

TECH-621. Communication Systems for Technological Education **Credit 3 (2-2)**

This course studies the communication systems model and its application to sending and receiving messages. Topics include planning and producing graphically and electronically generated messages to individual and mass audiences. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

TECH-622. Transportation Systems for Technological Education **Credit 3 (2-2)**

The significance of the evolution of transportation and transportation systems on human and societal development will be studied. Topics include the role of land, air, water, space, and energy systems on rural, urban, and suburban lifestyles. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

TECH-623. Research and Development in Technological Education **Credit 3 (2-2)**

This is a synthesis-based course where students research problems relative to any one of the four technological systems (Communications, Transportation, Construction, Manufacturing) and develop solution(s) to the identified problem(s). The interrelationship among the four technological systems will be explored. Laboratory activities will be included as appropriate for secondary, post-secondary, and industrial settings.

TECH-626. Curriculum Modification in Technological Education for Special Needs Populations **Credit 3 (3-0)**

This course examines program modifications for disadvantaged/handicapped learners in technological education. Topics include curriculum adaptation, instructional planning, teaching strategies, media development, and performance assessment for special needs learners.

GCS-630. Multimedia and Videography **Credit 3 (2-2)**

This course covers the development and utilization of multimedia presentations and videography in the educational environment. Topics include principles of composition, planning, editing, and producing multimedia presentations appropriate for educational or industrial settings. Computers and software packages will be used to develop the presentations.

GCS-631. Advanced Computer-Aided Design **Credit 3 (2-2)**

This course focuses on developing knowledge and skill with computer software used with solid modeling and the use of computer software to generate these models. Emphasis will also be placed on the creation of wire-frame and surface models. Analysis, fabrication and documentation of these models will be addressed.

GCS-632. Graphic Animation **Credit 3 (2-2)**

This course deals with the creation and manipulation of computer generated geometric shapes and models. Topics include creation of 3D scenes, assignment of materials, lights and textures, keyframing, rendering, and animation.

GCS-633. Advanced Machine Design and Drafting **Credit 3 (2-2)**

This course covers advanced drafting and design techniques associated with machine components and assembly. Topics include tool design and material selection, work-holding principles, design of jigs, fixtures and press working tools, inspection and gaging, joining processes, modular tooling, and economics of design.

GCS-634. Advanced Multimedia and Videography **Credit 3 (2-2)**

This course provides advanced strategies and techniques in the development of multimedia

presentations and videography. State of the art equipment will be used in addition to computers and software packages to produce professional presentations.

GCS-635. Advanced Principles of Graphic Communications Technology **Credit 3 (2-2)**
Advanced principles in graphic reproduction. Study of color applications, photographic applications, design and pre-press techniques. Technical experiences in reproduction methods and quality control.

GCS-636. Electronic Imaging in Distance Learning **Credit 3 (2-2)**
This course integrates the strategies and techniques of electronic imaging into distance learning applications. Areas of emphasis include Web page development and management unique to distance learning delivery systems for the Internet.

GCS-637. Industrial and Customer Relations in Graphic Communications **Credit 3 (3-0)**
This course focuses on industrial and customer relations within the field of graphic communications. Responsibilities and duties of the manager and his/her relationship to higher-level supervisors, subordinates, associates and customers are examined. Emphasis is placed on developing skills essential for persuasive communication.

GCS-644. Advanced Architectural Drafting and Design **Credit 3 (2-2)**
This course covers advanced drafting and design techniques associated with the building industries. Topics include the development of working drawings, site plans, elevations, sections, and details in accordance with building codes. Upon completion the student should be able to plan and develop architectural drawings that comply with accepted architectural standards and procedures.

TECH-660. Career Development and Work-based Learning **Credit 3 (3-0)**
This course covers implementation strategies for various work-based learning programs that will prepare youth to enter the workplace. Emphasis will be placed on going beyond the classroom into the community to develop workplace knowledge and skills.

TECH-661. Workforce Development Program Planning and Management **Credit 3 (3-0)**
This course covers principles and strategies of program planning and management for workforce development. Emphasis will be placed on scheduling, federal and state regulations, procedures and special issues.

TECH-662. Technological Education Course Construction **Credit 3 (3-0)**
Selecting, organizing, and integrating objectives, content, media and materials appropriate to technological courses will be discussed. Topics include strategies and techniques of designing and implementing group and individual teaching-learning activities, constructing teacher made instructional aides and devices, and curriculum planning and design.

TECH-663. History and Philosophy of Technological Education **Credit 3 (3-0)**
This course examines the chronological and philosophical development of technological education with special emphasis on its growth and function in American schools.

TECH-664. Occupational Exploration for Middle Grades **Credit 3 (3-0)**
Designed for persons who teach or plan to teach middle grades occupational exploration programs. Emphasis will be placed on occupational exploration in the curriculum, sources and uses of occupational information, approaches to middle grades teaching, and philosophy and concepts of occupational education.

TECH-665. Middle Grades Industrial Laboratory **Credit 3 (3-0)**
Course organization, teaching strategies, resource and facilities for teaching industrial-technological career exploration in Middle Grades is stressed. Emphasis is on occupational clusters in manufacturing, construction, communication, transportation, fine arts, and public service.

GCS-667. Independent Studies in Technological Education I **Credit 3 (3-0)**
This course involves intensive study in the field of technological education under the direction

of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

GCS-668. Independent Studies in Technological Education II **Credit 3 (3-0)**

This course involves intensive inquiry in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

TECH-669. Safety in the Instructional Environment of Technological Education **Credit 3 (3-0)**

This course examines the principles and techniques of organizing and supervising safety in technological education. Topics include instructional strategies, state and national laws, special hazards, color coding, and accident analysis.

GCS-670. Electronic Imaging in Graphic Communication **Credit 3 (2-2)**

Theory, principles and practices of electronic non-impact printing are investigated in class. Students will be given opportunities to explain, visit and utilize current non-impact printing systems through visits to industrial settings, classroom projects and special demonstrations.

TECH-670. Introduction to Workplace Training and Development **Credit 3 (3-0)**

Overview of the field of training and development. Management concerns related to organizing, operating, and financing training and development programs are discussed. Roles common to practitioners across the broad field of Human Resource Development are covered. Interpersonal perspectives and implications for the future are included.

TECH-671. Methods and Techniques for Workplace Training and Development **Credit 3 (3-0)**

Emphasis on the methods and techniques common to exemplary training programs. Designing learning programs and selecting appropriate media methods and resources using sound theoretical framework is the goal. Evaluation of programs and instruction is discussed.

TECH-672. Curriculum Development Using Microcomputers in Technological Education **Credit 3 (3-0)**

This course will focus on the theory, principles, concepts and philosophy of curriculum development. Topics include utilization of microcomputers, creation of learning activity packages, and integration of resources.

TECH-682. Computer Applications for Education and Industrial Training **Credit 3 (2-2)**

This course deals with strategies and techniques for the utilization of the computer for networking, videoconferencing, and distance learning. It also covers satellite and teleconferencing in addition to information services and the Internet as vehicles to assist in the educational process.

GRADUATE STUDENTS ONLY

TECH-715. Advanced Research and Development Practices for Technological Education **Credit 3 (3-0)**

This course is concerned with research and problem-solving related to technical subsystems of technological education. Emphasis is placed on research procedure and techniques, innovations or inventions, and the results from the research.

TECH-717. Special Problems I **Credit 3 (3-0)**

This course is an advanced study in modern technology that deals with recent developments, trends, practices and procedures in industries. Learning activities include individual and group research and experimentation involving selection, design, development, and evaluation of technical reports and instructional materials.

TECH-718. Special Problems II **Credit 3 (3-0)**

Individual study related to modern technology including research and experimentation involving selection, design, development, and evaluation of instructional materials will be the focus

of this course.

TECH-719. Seminar in Computer Aided Drafting and Design **Credit 3 (2-2)**

This course surveys the CADD software packages currently used in industrial and educational fields. It explores the uses and applications of these packages, and covers the transfer of data across platforms. Strengths of various software packages for special situations are emphasized.

CS-731. Advanced Graphical Techniques **Credit 3 (2-2)**

This course is designed to study the applications of American National Standards Institute (ANSI) and International Standards Organization (ISO) drafting standards, computer aided graphical problem-solving techniques, drafting methods in certain specialty areas, and different conventions related to tolerancing. Use of literature and research is expected.

GCS-733. Graphic Communications Organization and Management **Credit 3 (3-0)**

This course discusses formal and informal organizations, group dynamics, motivation, and managing conflict and change. Emphasis will be placed on different management practices and leadership styles as they relate to satisfaction and morale, organizational effectiveness, productivity, and profitability in the graphic communications industry.

TECH-762. Evaluation of Technological Education Programs **Credit 3 (3-0)**

This course examines standards, criteria, and strategies for evaluating technological education curricula, facilities, personnel, and programs. Activities include designing and conducting.

TECH-763. Technological Education for Elementary Grade **Credit 3 (3-0)**

This course includes the rationale, philosophy, concepts, curricula, resources, learning activities, methods, and evaluation for technological education in the elementary grades.

TECH-764. Supervision and Administration of Technological Education **Credit 3 (3-0)**

This course examines the relationship of technological education to the general curriculum and the administrative responsibilities involved. Courses of study, costs, coordination problems, class and laboratory organization, and the development of an effective program of supervision will be emphasized.

TECH-765. Evaluation of Training in Industrial Settings **Credit 3 (3-0)**

Study and application of principles of evaluation in industrial training settings. Emphasis is placed on test construction, measurement techniques, and evaluation results.

TECH-766. Curriculum Laboratories in Industrial Settings **Credit 3 (3-0)**

Development and preparation of instructional materials for industrial classroom use. Students select and develop significant areas of instruction for use in industrial settings. Modularized instruction that relates to industrial settings is studied for use and application in the private sector of business and industry. Opportunities are provided for review of actual industrial training materials.

TECH-767. Research and Literature in Technological Education **Credit 3 (3-0)**

This course studies research techniques applied to technical and educational papers and thesis classification of research. Topics include selection of subjects; delineation and planning of procedures; collection, organization and interpretation of data; and review of literature in technological education.

TECH-768. Technological Seminar **Credit 3 (3-0)**

This course is designed to enable non-thesis graduate majors to conclude educational and technical investigations. Each student is expected to plan and complete a research paper and present a summary of the findings to the seminar. Prerequisite: TECH 767.

TECH-769. Thesis Research **Credit 3 (3-0)**

TECH-788. Comprehensive Examination **Credit 0(0-0)**

Enrolling in this course is how one registers for the required comprehensive final exam.

MSIT-Master of Science in Industrial Technology (Graphic Communication Systems)

The School of Technology at North Carolina A&T State University offers a MSIT- Master of Science in Industrial Technology (Graphic Communication Systems) degree. This degree program is coordinated by the Department of Manufacturing Systems and is designed to increase students' understanding of industrial management challenges in an array of technical areas and to explore effective methods for dealing with accelerated technological changes.

ADMISSION REQUIREMENTS

The MSIT (Graphic Communication Systems) degree program, within the School of Technology, requires the GRE General Test as part of the admission process. A minimum score is not required at this time. Please contact the Graduate School Office for more information.

PROGRAM OBJECTIVES

The MSIT (Graphic Communication Systems) degree program is built upon the competencies achieved at the baccalaureate level in the graphic communication systems curriculum and thus enables students to secure applications oriented "technical-management" positions in today's industrial environment. The objectives of the program are:

1. To provide quality competency-based instruction so that men and women will be prepared to enter the fields of graphic communication systems.
2. To assist majors in developing those critical competencies in the sciences, communications, mathematics, and technical specialties essential to securing positions in related industrial, business and government careers.
3. To develop adequate problem solving, critical thinking, oral, and written communication skills.
4. To apply the use of various high technologies, e.g., computer-aided drafting and design (CADD), integrated internet technologies, flexography, and lithography.

TARGET AUDIENCE AND CAREER OPPORTUNITIES

This program is designed to serve the diverse needs of persons who are interested in pursuing careers in technology. Included in this group are the following: (1) persons currently employed in industrial management positions and have professional growth aspirations; (2) individuals recently completing their undergraduate study and want additional preparation prior to embarking on a career in industry; and (3) students interested in entering an advanced graduate degree program (Ph.D., Ed.D., etc.) and whose ultimate goal is university teaching and/or research. Graduates of the program should be able to perform more creatively and competently in leadership roles involving planning, problem solving, and decision-making. Additionally, the program is designed to enhance student competencies in the areas of research and scholarly writing.

INDUSTRIAL TECHNOLOGY (GRAPHIC COMMUNICATION SYSTEMS)

A total of 36 hours is required for the Master of Science in Industrial Technology. The total consists of 12 SH of Core Courses, 6 SH of Management Electives, 9 SH of Technical Electives and 9 SH of Required Courses.

PROGRAM CURRICULA (All courses are 3 credit hours)

Core Courses (12 credit hours)

MSIT 610	Problem Solving in Industrial Technology
MSIT 673	Industrial Productivity Measurement and Analysis
MSIT 700	Concepts of Technological Innovations
MSIT 740	Leadership Development Seminar

Graphic Communication Systems and Technological Studies
-Management Electives- (6 credit hours)

GCS 637	Industrial and Customer Relations in Graphic Communications
GCS 733	Graphic Communications Organization & Management
TECH 670	Introduction to Workplace Training and Development
TECH 671	Methods & Techniques of Workplace Training & Development

-Technical Electives- (9 credit hours)

GCS 601	Advanced Flexographic Methods
GCS 630	Multimedia and Videography
GCS 631	Advanced Computer-Aided Design
GCS 632	Graphic Animation
GCS 633	Advanced Machine Design and Drafting
GCS 634	Advanced Multimedia and Videography
GCS 635	Advanced Principles of graphic Communications Technology
GCS 636	Electronics Imaging in Distance Education
GCS 644	Advanced Architectural Drafting and Design
GCS 668	Independent Studies in Technological Education
GCS 670	Electronics Imaging in Graphic Communication
GCS 719	Seminar in Computer-Aided Drafting and Design
GCS 731	Advanced graphic Techniques
GCS 788	Comprehensive Examination (0 credit hours)
TECH 717	Special Problems I
TECH 718	Special Problems II

Required Courses (9 hours)

Non-Thesis Option

MSIT 750	Internship I
MSIT 751	Internship II
MSIT 789	Master's Project

Thesis Option

MSIT 780	Statistical and Research Methods in Industrial Technology II
MSIT 791	Thesis I
MSIT 792	Thesis II

COURSES WITH DESCRIPTION IN INDUSTRIAL TECHNOLOGY

Manufacturing Systems

MSIT-610. Problem Solving in Industrial Technology **Credit 3 (3-0)**

This course teaches the fundamentals of problem solving as they are applied to an industrial technology environment. Included are analytical as well as creative problem solving techniques. Industrial projects within assigned teams are required.

MSIT-673. Industrial Productivity Measurement and Analysis **Credit 3 (3-0)**

Study of work measurement and method analysis towards establishing work standards and measuring productivity in industries.

MFG-700. Concepts of Technological Innovations **Credit 3 (3-0)**

This course will provide instruction in the concepts of technological innovations. Contemporary issues are also explored.

MSIT-740. Leadership Development Seminar **Credit 3 (3-0)**

This is an experiential seminar designed for assessment of the individual's managerial strengths and weaknesses in a manufacturing management position. Current and evolving leadership issues will be discussed and leadership models will be presented. Managerial and

leadership issues in high participation work places will be stressed. Students will participate in behavioral simulations and receive psychometric feedback.

MSIT-750. Internship I

Credit 3 (0-6)

This course is designed to provide students with an internship experience in an industrial environment related to their technical discipline. Students must be employed full-time for one semester. Evaluation will be based on reports from the student's industrial supervisor and the university coordinator. Prerequisite: 15 hours graduate credit.

MSIT-751. Internship II

Credit 3 (0-6)

This course is designed to provide students with an additional semester of internship experience related to their technical discipline.

MSIT-789. Master's Degree Project

Credit 3 (3-0)

The master's degree project is designed to be a culminating experience for the master's degree. It is applications oriented and focuses on an actual project related to the student's technical discipline. The course is intended to integrate the learning from the classes taken in the degree program. Prerequisite: 24 hours graduate credit.

MSIT-791. Thesis I

Credit 3 (3-0)

The student will select a research topic that is of special interest and approved by his/her graduate thesis advisor. Prerequisite: MSIT 790 or consent of advisor.

MSIT-792. Thesis II

Credit 3 (3-0)

The student may enroll in this course to complete approved research for the thesis. Prerequisites: MSIT 790, MSIT 791 or consent of advisor.

Graphic Communication Systems and Technological Studies

GCS-601. Advanced Flexographic Methods

Credit 3 (1-4)

This course is designed to develop advanced proficiency in flexographic printing. It includes the prediction of future flexographic markets, products, substrates, inks, solvents, and industry standards for color processing.

GCS-630. Multimedia and Videography

Credit 3 (2-2)

This course covers the development and utilization of multimedia presentations and videography in the educational environment. Topics include principles of composition, planning, editing, and producing multimedia presentations appropriate for educational or industrial settings. Computers and software packages will be used to develop the presentations.

GCS-631. Advanced Computer-Aided Design

Credit 3 (2-2)

This course focuses on developing knowledge and skill with computer software used with solid modeling and the use of computer software to generate these models. Emphasis will also be placed on the creation of wire-frame and surface models. Analysis, fabrication and documentation of these models will be addressed.

GCS-632. Graphic Animation

Credit 3 (2-2)

This course deals with the creation and manipulation of computer generated geometric shapes and models. Topics include creation of 3D scenes, assignment of materials, lights and textures, keyframing, rendering, and animation.

GCS-633. Advanced Machine Design and Drafting

Credit 3 (2-2)

This course covers advanced drafting and design techniques associated with machine components and assembly. Topics include tool design and material selection, work-holding principles, design of jigs, fixtures and press working tools, inspection and gaging, joining processes, modular tooling, and economics of design.

GCS-634. Advanced Multimedia and Videography

Credit 3 (2-2)

This course provides advanced strategies and techniques in the development of multimedia

presentations and videography. State of the art equipment will be used in addition to computers and software packages to produce professional presentations.

GCS-635. Advanced Principles of Graphic Communications

Technology

Credit 3 (2-2)

Advanced principles in graphic reproduction. Study of color applications, photographic applications, design and pre-press techniques. Technical experiences in reproduction methods and quality control.

GCS-636. Electronic Imaging in Distance Learning

Credit 3 (2-2)

This course integrates the strategies and techniques of electronic imaging into distance learning applications. Areas of emphasis include Web page development and management unique to distance learning delivery systems for the Internet.

GCS-637. Industrial and Customer Relations in Graphic Communications

Credit 3 (3-0)

This course focuses on industrial and customer relations within the field of graphic communications. Responsibilities and duties of the manager and his/her relationship to higher-level supervisors, subordinates, associates and customers are examined. Emphasis is placed on developing skills essential for persuasive communication.

GCS-644. Advanced Architectural Drafting and Design

Credit 3 (2-2)

This course covers advanced drafting and design techniques associated with the building industries. Topics include the development of working drawings, site plans, elevations, sections, and details in accordance with building codes. Upon completion the student should be able to plan and develop architectural drawings that comply with accepted architectural standards and procedures.

GCS-667. Independent Studies in Technological Education I

Credit 3 (3-0)

This course involves intensive study in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

GCS-668. Independent Studies in Technological Education II

Credit 3 (3-0)

This course involves intensive inquiry in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

GCS-670. Electronic Imaging in Graphic Communication

Credit 3 (2-2)

Theory, principles and practices of electronic non-impact printing are investigated in class. Students will be given opportunities to explain, visit and utilize current non-impact printing systems through visits to industrial settings, classroom projects and special demonstrations.

GCS-731. Advanced Graphical Techniques

Credit 3 (2-2)

This course is designed to study the applications of American National Standards Institute (ANSI) and International Standards Organization (ISO) drafting standards, computer aided graphical problem-solving techniques, drafting methods in certain specialty areas, and different conventions related to tolerancing. Use of literature and research is expected.

GCS-733. Graphic Communications Organization and Management

Credit 3 (3-0)

This course discusses formal and informal organizations, group dynamics, motivation, and managing conflict and change. Emphasis will be placed on different management practices and leadership styles as they relate to satisfaction and morale, organizational effectiveness, productivity, and profitability in the graphic communications industry.

GCS-788 Comprehensive Examination

Credit 0(0-0)

Enrolling in this course is how one registers for the required comprehensive final examination.

TECH-670. Introduction to Workplace Training and Development

Credit 3 (3.0)

Overview of the field of training and development. Management concerns related to organizing, operating, and financing training and development programs are discussed. Roles common to practitioners across the broad field of Human Resource Development are covered. Interpersonal perspectives and implications for the future are included.

TECH-671. Methods and Techniques for Workplace Training and Development

Credit 3 (3.0)

Emphasis on the methods and techniques common to exemplary training programs. Designing learning programs and selecting appropriate media methods and resources using sound theoretical framework is the goal. Evaluation of programs and instruction is discussed.

TECH-717. Special Problems I

Credit 3 (3-0)

This course is an advanced study in modern technology that deals with recent developments, trends, practices and procedures in industries. Learning activities include individual and group research and experimentation involving selection, design, development, and evaluation of technical reports and instructional materials.

TECH-718. Special Problems II

Credit 3 (3-0)

Individual study related to modern technology including research and experimentation involving selection, design, development, and evaluation of instructional materials will be the focus of this course.

TECH-719. Seminar in Computer Aided Drafting and Design

Credit 3 (2-2)

This course surveys the CADD software packages currently used in industrial and educational fields. It explores the uses and applications of these packages, and covers the transfer of data across platforms. Strengths of various software packages for special situations are emphasized.

Human Performance and Leisure Studies

Deborah J. Callaway, Chairperson
Suite 215 Corbett Gymnasium
(336) 334-7719
<http://www.ncat.edu/~schofed/>

OBJECTIVES

The Department of Human Performance and Leisure Studies (HPLS) offer an advanced graduate program of study leading to a Master of Science in Physical Education degree. The purpose of the advanced program of study is to prepare public school practitioners and professionals to take leadership roles in the areas of teaching and research through an interdisciplinary and standard-based graduate curriculum. Specifically, the objectives of the program are the following:

1. To provide an advanced level of study in the areas of teaching and research in physical education and related fields.
2. To provide students with advanced competencies in developing, implementing, and evaluating quality programs of physical activities for a wide range of diverse population.
3. To further develop technological competencies in physical education and related fields.

DEGREE OFFERED

Master of Science in Physical Education

GENERAL PROGRAM REQUIREMENTS

The admission of students to graduate degree program is consistent with the general admission requirements of the School of Graduate Studies. Students applying to graduate study in the Department of Human Performance and Leisure Studies must also satisfy the following criteria for admission in the program:

- A Bachelor's degree in Physical Education or a related field from an accredited institution
- Three (3) letters of recommendation
- Overall undergraduate GPA of 2.60
- Official scores on GRE (Graduate Record Examination) or the MAT (Miller Analogies Test) taken during the last five (5) years, and
- A goal statement

A student wishing to be accepted as a candidate for the Teaching option must hold a Class "A" teaching certificate. If a person does not qualify for certification appropriate undergraduate or graduate courses may be taken to correct the deficiency. Finally, all Post Baccalaureate Studies (PBS) candidates must have approval from the Department Chairperson for admission.

DEPARTMENTAL REQUIREMENTS

The Department of Human Performance and Leisure Studies provide an advanced level of study in two tracks: teaching and non-teaching. The teaching track has three areas of concentration, namely (a) teacher education, (b) adapted physical education, and (c) sport psychology. Similarly, the non-teaching tract has the same concentrations EXCEPT teacher education. Additionally, the program offers a Teaching Licensure Only/Lateral Entry option.

The student may elect to take thirty-six (36) hours of course work and write a thesis for three (3) hours credit in order to satisfy the requirements of thirty-nine (39) total hours. The student may also elect not to write a thesis and take an additional three (3) credit hours research seminar course (HPED 798) to complete the required thirty-nine (39) total credit hours.

Non-Teaching—A student may complete the Master's Degree in the non-teaching option without meeting state licensure requirements for teaching. This option is designed for individuals working in the field or related fields where a teaching license is not required. This option will not lead to any form of teacher licensure.

Licensure Only—The Licensure Only option is available to those individuals wishing to satisfy North Carolina teaching licensure requirements. Individuals must possess an earned undergraduate degree and must remove undergraduate deficiencies at the beginning of his/her graduate studies. Students pursuing licensure must apply for admission to the Teacher Education Program and pass Praxis II prior to pursuing student teaching.

CAREER OPPORTUNITIES

A degree in this field provides content for students preparing for careers in the public schools, college and junior college teaching, research, public service and further academic advancement.

GRADUATE COURSE OFFERRINGS

HPED 700	Evaluation of Atypical Motor Performance	3
HPED 721	Current Problems and Trends in Physical Education	3
HPED 723	Supervision in Health and Physical Education	3
HPED 731	Exercise Physiology	3
HPED 732	Sport Psychology	3
HPED 733	Motor Learning and Performance	3
HPED 734	Applied Sport Psychology	3
HPED 735	Sport Psychology Practicum	3
HPED 742	Administration of Interscholastic and Intercollegiate Athletics	3
HPED 760	Program Development in Adapted Physical Activity	3
HPED 761	Early Childhood Adapted Physical Activity	3
HPED 762	The Teaching of Adapted Physical Activity	3
HPED 784	Research Statistics for Physical Education	3
HPED 786	Scientific Foundations of Human Movement	3
HPED 798	Research Seminar	3
HPED 799	Thesis	3

DEPARTMENT OF HUMAN PERFORMANCE AND LEISURE STUDIES GRADUATE COURSE DESCRIPTIONS

HPED-700. Evaluation of Atypical Motor Performance **Credit 3 (2-2)**

This course is designed to study the various methods of assessing and evaluating atypical motor performance. Emphasis is placed on ecologically based data collection, interpretation, and instruction. A practicum is required.

HPED-721. Current Problems and Trends in Physical Education **Credit 3 (3-0)**

This course is designed for experienced teachers to address problems in teaching and coaching on all educational levels. Trends and the future direction of the profession will be addressed through research and class discussion.

HPED-723. Supervision in Health and Physical Education **Credit 3 (3-0)**

This course is an in depth-study of management theories and policies applicable to the administration of Health and Physical Education classes at all levels from elementary through higher education. The planning, implementing and evaluating of classroom activities are emphasized.

HPED-731. Exercise Physiology **Credit (2-1)**

This course is designed to give the student an understanding of the application of principles and theories of physiology as it applies to the physical training and conditioning of athletes for sports participation.

HPED-732. Sport Psychology **Credit 3 (3-0)**

This course is the study of current and classical theories of sport psychology as applied to human performance. Emphasis is placed upon motivation, attention, anxiety, human factors and cognitively based psychological skills training programs

HPED-733. Motor Learning and Performance **Credit 3 (3-0)**

This course is the study of current theories and principles of human motor behavior as applied

to the acquisition and analysis of motor skills. Emphasis will be placed upon learning concepts, practice, arousal, methodology, transfer and distribution.

HPED-734. Applied Sport Psychology

Credit (3-0)

This course involves current research theories and practices in applied sport psychology, specifically sport specific psychology programs, generally involving psychological skills training with competitive sport participants.

HPED- 735. Sport Psychology Practicum

Credit (2-2)

This course provides supervised experiences in the organization, administration and evaluation of applied sport psychology programs, generally involving psychological skills training with competitive sport participants.

HPED-742. Administration of Interscholastic and Intercollegiate Athletics

Credit 3 (3-0)

This course is designed to provide management theories and principles for the organization and administration of interscholastic and intercollegiate athletics. The components of budgeting, scheduling, staffing, coordination, planning and legal liability will be thoroughly discussed.

HPED-760. Program Development in Adapted Physical Activity

Credit 3 (2-2)

This course is designed to study the various approaches in developing adapted physical activity programs for individuals with disabilities, with emphasis on an ecological approach. Content focus is placed on inclusion, diversity, and non-categorical elements of program development, implementation, and evaluation. A practicum is required.

HPED-761. Early Childhood Adapted Physical Activity

Credit 3 (2-2)

This course focuses on the planning, implementation and evaluation of inclusive motor development programs for very young children with special needs. Emphasis is placed on current practices in assessment and programming, family involvement, and playground safety. A practicum is required.

HPED-762. The Teaching of Adapted Physical Activity

Credit 3 (1-4)

This course is designed to study and apply various instructional approaches to the teaching of adapted physical activity in an inclusive setting. Emphasis is placed on instructional styles and strategies, organizational techniques, and teaching effectiveness within an ecological framework. Internship is required.

HPED-784. Research Statistics for Physical Education

Credit 3 (3-0)

This course is designed to give the student a sound foundation in the principles and applications of various statistical methods as they relate to conducting and evaluating research in Physical Education. The course includes descriptive statistics, probability theory, sampling distribution, inferences about means and standard deviations, hypothesis testing, regression, correlation, Chi-square and non-parametric methods.

HPED-786. Scientific Foundations of Human Movement

Credit 3 (3-0)

This course is designed to discuss and explore the scientific base and approaches to studying human movement, including ethical decision making in human movement research.

HPED-798. Research Seminar

Credit 3 (3-0)

This course is designed to provide the students with a culminating experience by conducting writing and presenting a research project to a forum of students and faculty. Prerequisites: CUIN 711, PHED 784, PHED 786 and completion of 50% of the course of studies.

HPED-799. Thesis

Credit 3 (3-0)

An in-depth research project in the area of physical education. Each student will have an advisor and Thesis Committee, in accordance with the procedures within the Graduate School, who will provide guidelines in the completion of the study. Each student will present his/her findings and will provide a successful defense before the Thesis Committee.

HISTORY

Olen Cole, Jr., Chairperson
324 Gibbs Hall
(336) 334-7831
coleo@ncat.edu

OBJECTIVES

The Master of Science program builds upon the knowledge and skills already mastered by teachers at the undergraduate level. The required 15 hours of advanced professional core courses and the 24 hours of courses in the content area provide opportunities for teachers to advance their knowledge of pedagogy and content. Courses in content and the professional education core are designed to connect with and enhance what teachers are actually doing in their classrooms. The role, use, integration, and application of technology in the planning and teaching process are also emphasized. The major goal is to produce social studies educators, teachers, leaders, and scholars, who are catalysts for learning.

DEGREE OFFERED

Master of Science - History Education

GENERAL PROGRAM REQUIREMENTS

In addition to the general requirements specified in the description of the degree program in Education, a student wishing to be accepted as a candidate for the degree of Master of Science in Education with a concentration in History must hold or be qualified to hold a Class A teaching certificate in History or Social Studies. If a person does not qualify for certification, appropriate undergraduate or graduate courses may be taken to correct this deficiency.

CAREER OPPORTUNITIES

The skills and knowledge learned in history and social science courses can lead to careers in education, journalism, business, archives and museums, international affairs, and government service, among others. The M.S. Degree Program in History Education prepares students for classroom teaching in secondary schools. Businesses also find that teacher education graduates make good human relations specialists, personnel directors, technical writers, sales managers, directors of training programs, and administrators.

DEPARTMENTAL REQUIREMENTS

To complete the requirements for the degree of Master of Science in Education with a concentration in History, the student may elect the thesis option or the non-thesis option. A comprehensive examination is required in History as well as in Education. Students must maintain a grade point average of 3.0.
coleo@ncat.edu

PROGRAM OF STUDY

Required History Content Area Courses 24 hours

HIST 735 Historiography (3)
HIST 610 Seminar in the History of Twentieth Century Technology (3)
HIST 730 Seminar in History (3)
HIST (United States History) (3)
HIST (European History) (3)
HIST (Courses/Non-Western History/minorities) (6)
Social Science Elective (Non-Thesis Option) (3)

HIST 750 Thesis in History (Thesis Option) (3)

Professional Education Core Courses 15 hours

1. CUIIN 619 Learning Theories (3)
2. CUIIN 721 Advanced Methods (3)
3. CUIIN 729 Diversity Issues in K-12 Public Schools (3)
4. CUIIN 711 Methods and Techniques of Research (3)
5. CUIIN 728 Integrating Technology into the K-12 Curriculum (3)

OTHER REQUIREMENTS

1. Research Project or Thesis
2. Performance-Based Portfolio
3. Comprehensive Examination

**PROGRAM OBJECTIVES OF THE MASTER OF SCIENCE IN
EDUCATION WITH A CONCENTRATION IN HISTORY**

Students in the M.S. degree program in History Education are provided the opportunity to:

1. Acquire advanced knowledge of pedagogical and thematic subject matter standards of the social studies curriculum.
2. Acquire advanced knowledge of major historiographical schools of thought and significant periods of history.
3. Become more aware of the contributions of historical and social science research to policy analysis and decision making.
4. Understand how students differ in their approaches to learning and be able to create teaching and learning strategies that address the needs of diverse learners.
5. Understand the impact of various groups, institutions, and nations on global history and development.
6. Improve performance and practice through self-evaluation, reflection, and applied research.
7. Understand how to select appropriate objectives consistent with state and local curriculum guide lines, the learning needs of students, and the standards established by the National Council of Social Studies and Interstate New Teacher Assessment and Support Consortium (INTASC).
8. To demonstrate instructional leadership as an individual and collaboratively.

History Courses

HIST 600	The British Colonies and the American Revolution
HIST 603	Civil War and Reconstruction
HIST 605	Twentieth Century Russian History
HIST 606	United States History, 1900-1932
HIST 607	United States History, 1932-Present
HIST 610	Seminar in the History of Twentieth Century Technology
HIST 615	Seminar in African-American History
HIST 616	Seminar in African History
HIST 617	Readings in African History
HIST 618	The African Diaspora
HIST 620	Seminar in Asian History
HIST 621	Seminar in Latin American and Caribbean History
HIST 622	History of Asian Women
HIST 623	Topics in East Asian Culture
HIST 626	Revolutions in the Modern World
HIST 628	The Civil Rights Movement
HIST 629	Seminar on the History of Early Modern Europe
HIST 630	Seminar in European History, 1815-1914
HIST 631	Studies in Twentieth Century Europe, 1914 to the Present
HIST 633	Independent Study in History
HIST 701	Recent United States Diplomatic History
HIST 703	The Pacific War

HIST 712	Twentieth Century African-American History
HIST 730	Seminar in History
HIST 735	Historiography
HIST 740	History, Social Science, and Contemporary World Problems
HIST 750	Thesis in History

Geography Courses

GEOG 640	Topics in Geography of the United States and Canada
GEOG 641	Topics in World Geography

COURSE DESCRIPTIONS FOR HISTORY

HIST-600. The British Colonies and the American Revolution **Credit 3 (3-0)**

The planting and maturation of the English colonies of North America. Relationships between Europeans, Indians, and transplanted Africans, constitutional development, religious ferment, and the colonial economy are studied.

HIST-603. Civil War and Reconstruction **Credit 3 (3-0)**

Causes as well as constitutional and diplomatic aspects of the Civil War, the role of the African-American in slavery, in war, and in freedom; and the socio-economic and political aspects of Congressional Reconstruction and the emergence of the New South are studied.

HIST-605. Twentieth Century Russian History **Credit 3 (3-0)**

This is a reading, research, and discussion course that examines history of Twentieth century Russia with special emphasis on the Russian Revolution, the development of Communist society, the impact and legacy of Stalin, relations with the United States and other countries during the Cold War, the demise of the Soviet Union, and current problems facing post-Soviet Russia.

HIST-606. U.S. History, 1900-1932 **Credit 3 (3-0)**

Emphasizes political, economic, social, cultural and diplomatic developments from 1900 to 1932 with special attention to their effect upon the people of the United States and their influence on the changing role of the U.S. in world affairs.

HIST-607. U.S. Since 1932-Present **Credit 3 (3-0)**

With special emphasis on the Great Depression, New Deal, the Great Society, and the expanding role of the United States as a world power, World War II, Cold War, Korean and Vietnam conflicts are studied. Major themes include the origin, consolidation, and expansion of the New Deal, the growth of executive power, the origins and spread of the Cold war, civil liberties, and civil rights, and challenges for the extension of political and economic equality and the protection of the environment.

HIST-610. Seminar in the History of Twentieth Century Technology **Credit 3 (3-0)**

A reading, research, and discussion that investigates the development and, especially, the impact of major Twentieth century technologies. Attention will also be given to the process of invention, the relationship between science and technology, and the ethical problems associated with some contemporary technologies.

HIST-615. Seminar in African-American History **Credit 3 (3-0)**

This is a reading, research, and discussion course that concentrates on various aspects of the life and history of African-Americans. The emphasis is placed on historiography and major themes including nationalism, black leadership and ideologies, and economic development.

HIST-616. Seminar in African History **Credit 3 (3-0)**

Research, writing, and discussion on selected topics in African history.

HIST-617. Readings in African History **Credit 3 (3-0)**

(By arrangement with instructor.)

- HIST-618. The African Diaspora** **Credit 3 (3-0)**
 This is an advanced reading, research, and discussion course on the historical experience of people of African descent in a global context. It examines the worldwide dispersal and displacement of Africans over time, emphasizing their migration and settlement abroad over the past five centuries.
- HIST-620. Seminar in Asian History** **Credit 3 (3-0)**
 Research, writing, and selected topics in Asian history.
- HIST-621. Seminar in Latin American and Caribbean History** **Credit 3 (3-0)**
 This course requires research, writing, and discussion of selected topics in Latin American and Caribbean History including, urban and rural conflicts, social revolution, race relations, problems of underdevelopment, and contemporary issues.
- HIST-622. History of Asian Women** **Credit 3 (3-0)**
 This course first briefly examines the conditions of Asian (especially South Asian and East Asian) women in traditional societies and then focuses on the changes in women's status in modern times (since 1800). It covers primarily the following topics: women and economic modernization (especially the impact of industrialization on women), the impact of the introduction of Western ideas (such as feminism) on women, women and wars (revolutions)-especially in China, Korea, and Vietnam, women and crimes, women's political participation, and gender relations.
- HIST-623. Topics in East Asian Culture** **Credit 3 (3-0)**
 This course first aims at illuminating some key features of East Asian culture, especially in modern times. It is concerned with East Asians' belief on a variety of issues (e.g., human relations, man-nature relations, state-society relations, and health) and the changes of these beliefs in the context of Western influence. Considerable attention will be given to such major intellectual schools as Confucianism, Daoism, and Buddhism.
- HIST-626. Revolutions in the Modern World** **Credit 3 (3-0)**
 A seminar course stressing comparative analysis of revolutions and revolutionary movements in the United States, France, Russia, China, Cuba, and Iran. Students will also evaluate theories of revolution in light of historical examples.
- HIST-628. The Civil Rights Movement** **Credit 3 (3-0)**
 From original research, class lectures, and discussions, students will become familiar with the nature of the Civil Rights Movement; will evaluate its successes and failures; and will analyze the goals and tactics of each major participating Civil Rights organization. Students will also evaluate the impact of the Civil Rights Movement on American society.
- HIST-629. Seminar on the History of Early Modern Europe** **Credit 3 (3-0)**
 Through extensive readings, discussion, research, and writing, students will examine selected topics of enduring importance in the history of Europe from the Renaissance through the French Revolution.
- HIST-630. Studies in European History, 1815-1914** **Credit 3 (3-0)**
 Intensive study of selected topics in Nineteenth Century European history.
- HIST-631. Studies in Twentieth Century Europe, 1914-Present** **Credit 3 (3-0)**
 This course offers an intensive study of key topics in Twentieth century European history, including World Wars I and II, the Russian Revolution, Hitler and the Holocaust, the Depression, the Cold War and bipolarism, the Welfare State, the Common Market, the collapse of Communism in Eastern Europe, and current problems.
- HIST-633. Independent Study in History** **Credit 3 (3-0)**
(By arrangement with instructor.)
- HIST-701. Recent United States Diplomatic History** **Credit 3 (3-0)**
 This course examines episodes in the history of American foreign relations that were especially important in influencing persistent patterns of this nation's role in international relations.

Possible examples studied: Pearl Harbor, the Cold War, Korean War, Cuban missile crisis, Vietnam, nuclear arms limitation, and black Africa.

HIST 703. The Pacific War **Credit 3 (3-0)**

This course examines the origins, conduct, and consequences of the Pacific War, which was an important part of World War II. The course will discuss the rise of Japan as a world power and its expansion in East Asia, particularly in China, and Southeast Asia. The course will also explore why and how Japan came into military conflict with the United States in the Pacific region, which resulted in the collapse of the Japanese colonial empire. (F;S;SS)

HIST-712. Twentieth Century African-American History **Credit 3 (3-0)**

This course involves research, reading, discussion, and analysis of major facets of African-American life in the United States from 1900 to the present. It requires a major research paper.

HIST-730. Seminar in History **Credit 3 (3-0)**

Topics to be selected by students and instructor. Includes a major research project.

HIST-735. Historiography **Credit 3 (3-0)**

This course will examine historians and their philosophical and methodological approaches to the study of history and recent developments in analysis and theory. Overviews of the fundamental issues and debates in the fields of history will be discussed. Basic computer skills will also be emphasized.

HIST-740. History, Social Science, and Contemporary World Problems **Credit 3 (3-0)**

Readings, discussions, and reports on the relationships between history and the social sciences as a whole, as well as their combined roles in dealing with contemporary world problems.

HIST-750. Thesis in History **Credit 3 (3-0)**

Thesis work will be done with the appropriate instructor in accordance with field of interest.

CUIN-725. Problems and Trends in Teaching the Social Sciences **Credit 3 (3-0)**

Current strategies, methods, and materials for teaching the social sciences. Emphasis on innovations, evaluation and relation to learning. Provision for clinical experiences.

COURSE DESCRIPTIONS FOR GEOGRAPHY

GEOG-640. Topics in Geography of the United States and Canada **Credit 3 (3-0)**

Selected topics in cultural geography of the United States and Canada are studied intensively. Emphasis is placed upon individual reading and research and upon group discussion.

GEOG-641. Topics in World Geography **Credit 3 (3-0)**

Selected topics in geography are studied intensively. Concern is for cultural characteristics and their interrelationships with each other and with the habitat. Emphasis is upon reading, research, and discussion.

Human Development and Services

Wyatt D. Kirk, Chairperson
212 Hodgin Hall
(336) 334-7916
kirkw@ncat.edu

OBJECTIVES

The objectives of the Department of Human Development and Services are to prepare individuals for professional roles in Adult Education, Counseling, and School Administration. Departmental studies include philosophical, theoretical, and methodological foundations for adult educational and counseling practices; practical examination of human development and learning through the life span, supervised experience in practice settings and leadership preparation for schools and other educational organizations in a diverse and technological society.

Departmental graduates pursue professional careers within a diversity of human services settings, including schools, post-secondary and higher education, public and private counseling centers, rehabilitation agencies, community education and development, services administration, corrections, human resource development/training, health education, and university extension programs. School Administration graduates work in administrative positions at the school building level, and/or assume positions with local, state, and national organizations that focus on educational issues in professional development, curriculum, research or policy making. Graduates of School Administration are eligible for licensure from the North Carolina State Department of Public Instruction (SDPI) and may qualify the individual for administration certification in other states.

Although many participants are enrolled in full-time graduate study, the Department welcomes practicing professionals who choose to pursue their studies on a part-time basis. Course work in the Department is generally offered in the evenings to accommodate the professional development needs of practicing adult educators, counselors, and school administrators.

DEGREES OFFERED

Master of Science Degree in Adult Education
Master of Science Degree in Counselor Education
Master of Science Degree in Human Resources (Community/Agency)
Master of Science Degree in Human Resources (Rehabilitation Counseling)
Master of Science Degree in School Administration

GENERAL PROGRAM REQUIREMENTS

The Department of Human Development and Services at North Carolina A&T State University accepts and reviews applications for admission twice a year. Deadlines for counseling applications are April 1st for fall admissions and November 1st for spring admissions. Adult Education deadlines are ongoing for fall and spring admissions.

School Administration program deadlines are March 1st for fall admissions and November 1st for spring admissions. Persons applying for graduate study in the Department must obtain an application for admittance from the School of Graduate Studies. Prospective kirkw@ncat.edu students must complete and forward the application including submission of three letters of recommendation to the Graduate School.

The applicants packet will be reviewed by the Graduate School and the admissions committee of the Department of Human Development and Services. Applicants may be requested to participate in a pre-admissions interview with departmental faculty. The admissions decision is made at the department level, and is based on the recommendation of the admissions committee and approval by the Departmental Chairperson.

Persons applying for graduate study within Departmental Programs should have an overall undergraduate GPA of 3.0 or higher on a 4 point system; and 2.8 on a 4.0 scale for School Administration. Primary factors in the admissions decision include academic background,

demonstrated professional and volunteer experience appropriate to Departmental programs of study, letters of recommendation or reference forms and official transcripts of all prior academic work.

The GRE is not required for admission unless the Departmental Admissions Committee recommends a student take it. However, persons applying for graduate study in counseling may be required to take the Graduate Record Examination (GRE) and have these scores submitted to the graduate school as a part of the application process, if asked to do so by the Departmental Admissions Committee. GRE scores will be considered in the overall admissions decision. The GRE requirement does not apply to adult education master's candidates. If approved, applicants who do not meet minimum GPA requirements may be admitted to Departmental programs on the weight of other factors. School Administration applicants are required to present GRE or MAT (Miller Analogies Test) scores that are not more than five (5) years old. Test of English as a Foreign Language is required for international students. Applicants for graduate study in Adult Education who have creditable professional and/or volunteer experience in adult education practice are encouraged to submit a brief portfolio in addition to, and in support of, the resume. The portfolio would include samples of original work (i.e. workshops, presentations, publications) from employment or volunteer experience (i.e. voluntary organizations, church). The portfolio will be considered in the overall admissions decision as evidence of applicable professional and volunteer experience.

For a complete copy of the admissions policy, contact the department office. Faculty recommendations are preferred; however, employer recommendations may be submitted if you are unable to obtain a faculty recommendation. A current resume and professional portfolio should be submitted to:

North Carolina A&T State University
School of Graduate Studies
ATTN: Admissions
120 Gibbs Hall
Greensboro, NC 27411

DEPARTMENT REQUIREMENTS

Adult Education majors must successfully complete a minimum of 36 credit hours of approved graduate study. The program of study is composed of a professional core curriculum consisting of 21 graduate semester hours, including a faculty supervised practicum experience, and a minimum of 15 semester hours in a research or practice concentration. The concentration entails graduate research and cognate studies in an adult education specialty (thesis option) or an adult education practice concentration (non-thesis option). The concentration (thesis or non-thesis) is determined by the participant in collaboration with his or her faculty advisor and is subject to approval by the Department Chair. Practice concentrations are currently designated in Community Education, Counseling, Higher Education, and Instructional Technology.

As a culminating experience, the Research Concentration (Thesis Option) participant must research and write a masters' thesis in the field of adult education under the supervision of his/her major advisor, and defend it before a departmental Thesis Research Committee. Practice Concentration (Non-Thesis Option) participants must complete a four-hour master's comprehensive examination administered by the Department. In addition to serving Departmental master's candidates, students enrolled in master's programs other than Adult Education, as well as holders of master's degrees who are not currently engaged in graduate study, may enroll, with administrative approval, in Adult Education professional core courses or concentrations to augment their studies and professional development.

Counseling majors must complete 60 hours of graduate work with the Rehabilitation Counseling track. The program of study is composed of a professional core curriculum consisting of 48 graduate semester hours, including a faculty supervised practicum experience and two 300 hour internships, in addition to a minimum of 12 semester hours of electives. The electives allow graduate students the opportunity to develop specialties in the counseling profession. Students will not be allowed to take the Counseling Comprehensive Examination unless all professional core courses have been taken excluding HDSV 765, 780 and 790. There are four tracks as options in the counseling curriculum. The Community/Agency Counseling track prepares students for a variety of counseling careers in the public and private sector, including post-secondary education settings. The School Counseling track prepares students for counseling positions in elementary, middle, and high schools. The Human Resources Rehabilitation

Counseling track prepares students for positions in a variety of rehabilitation settings.

The Human Resource (Rehabilitation Counseling) program is designed to prepare culturally competent counselors who specialize in counseling persons with disabilities. The 48 hour counseling program has the following objectives: (1) increasing the student's knowledge and skills regarding the role and function of rehabilitation counselors, (2) preparing rehabilitation counselors who function ethically and competently in a multicultural context, and (3) increasing the number of underrepresented minority counselors trained in rehabilitation counseling. Graduates of the Rehabilitation Counseling track pursue credentials as a Certified Rehabilitation Counselor (CRC), a National Certified Counselor (NCC), and a Licensed Professional Counselor (LPC). Rehabilitation Counselors are employed in the following settings: (a) public/private rehabilitation agencies, (b) community rehabilitation programs, (c) private practice, (d) non-profit rehabilitation agencies, (e) rehabilitation hospitals, (f) correctional facilities, (g) mental health centers, (h) independent living centers, (i) half way houses, and (j) substance abuse facilities. Beginning Fall 2005, the Rehabilitation Counseling program will offer a 12 hour concentration in Rehabilitation Administration for students desiring additional preparation for leadership roles within rehabilitation settings.

The Master of School Administration Degree Program is designed to prepare individuals to lead schools and other educational organizations in a diverse and technological society. Completion of this program leads to eligibility for licensure from the North Carolina State Department of Public Instruction and may qualify the individual for administration certification in other states. Graduates of this program will work in administrative positions at the school building level, and/or assume position with local state and national organizations that focus on educational issues in professional development, curriculum, research or policy making.

Program Objectives

The objectives of the program are to:

- Prepare leaders who are visionary, reflective, and collaborative managers with schools, business and the community.
- Prepare leaders for school administration and leadership in local, state, regional, and national educational organizations.
- Prepare leaders who know how to conduct research and use data analysis in problem solving and decision-making.
- Prepare leaders who demonstrate knowledge of curriculum, assessment, use of technology, and are reflective in their practice.
- Prepare leaders with the skills to respond to gender, equity, and quality issues.
- Prepare leaders who are ethically sensitive and open-minded.
- Prepare leaders who are responsive to social, political, and economic change.
- Provide individuals the opportunity to demonstrate leadership skills, apply theoretical knowledge and demonstrate appropriate dispositions.

Degree

All students enrolled in the Master of School Administration Degree Program must successfully complete 42 hours of study including 30 hours in the major and 12 hours in a field based internship and internship seminar. A maximum of 6 hours of graduate transfer credits with a grade of "B" or higher may be accepted toward completion of the degree. Transfer credits must be at the graduate level for a grade, within the last five years, and may not have been used to fulfill the requirements for another master's degree.

Students admitted to the Master of School Administration Degree Program will be assigned to a cohort group through the registration process. There will be separate cohort groups for full-time and extended time students. Students may choose either a full-time or extended time program of study. Full-time students must complete the program within a two-year period, including the yearlong internship. Extended time students must complete the program within a three-year period including summers and the yearlong internships.

Admission Requirements

- Submit a formal application to the School of Graduate Studies, North Carolina Agricultural and Technical State University.
- Hold a Bachelor of Arts or Bachelor of Science degree from an accredited college or university in this country or the equivalent in an accredited institution outside the United

States.

- Have an undergraduate grade point average of 2.8 on a 4.0 scale.
 - Present GRE or MAT (Miller Analogies Test) scores that are not more than five (5) years old.
 - Have a minimum of four (4) years of successful teaching experience and hold a Performance based North Carolina Teaching Certificate.
 - Provide three letters of academic recommendations.
 - Participate in an interview to determine knowledge of relevant education issues, insight into problems of schooling, and level of oral communication skills.
- 8 Present a portfolio of educational and professional artifacts.
- Provide a writing sample in response to a leadership case study problem.

Financial Assistance

The North Carolina Principal Fellows Program is a scholarship loan program funded by the North Carolina General Assembly and based upon academic merit (financial need is not a consideration) to assist individuals in earning the master's degree in school administration in preparation for a career in school administration. Each scholarship loan will provide up to a two-year scholarship in the amount of twenty thousand dollars (\$20,000) per year to support students who enroll in and complete a full-time two-year masters degree program in school administration at a participating institution.

Internship Requirements

You must be enrolled as a full-time graduate student (9 hours minimum) and serve as a full-time intern in a public school during the second year as a Principal Fellow. While serving as an intern, Principal Fellows receive a stipend, in addition to the scholarship loan, equal to the 0-4 steps on the state salary schedule for assistant principals (contingent on funding from the General Assembly).

Information may be obtained by contacting:

Dr. Karen F. Geringer
North Carolina Principal Fellows Program
P.O. Box 2688
Chapel Hill, North Carolina 27515-2688
(919) 962-4575

PROGRAM OF STUDY FOR THE M.S. IN ADULT EDUCATION

Professional Core (21 credit hours)		Credits
ADED 707	Foundations of Adult Education	3
ADED 708	Methods in Adult Education	3
ADED 709	Adult Development and Learning	3
ADED 700	History and Philosophy of Adult and Continuing Education	3
ADED 701	Organization, Administration, & Supervision of Adult Education Programs	3
ADED 716	Qualitative Research in Adult and Continuing Education	
ADED 702	Practicum and Seminar in Adult Education 3 (50 contact hours or more)	

Prerequisites: completion of 21 credit hours including 15 hours of professional core courses, or permission of the instructor.

Concentration (15 hours minimum)		Credits
Research Concentration (Thesis Track)		
HDSV 707	Applied Research	3
	Comparable Research Design Course	3
ADED 705	Thesis Research in Adult Education	6
	Approved Electives	6

In lieu of taking the master's comprehensive examination, thesis students will defend their completed research before

their respective faculty advisory committee.

Practice Concentration (Non-Thesis Track)
Electives to comprise a practice concentration 15
In consultation with his/her advisor, the student may elect to pursue a designated practice concentration (below), or develop a unique concentration from among university-wide course offerings that is tailored to his/her career interests and goals.

PRACTICE CONCENTRATIONS

Adult Education

In consultation with their advisors, non-thesis students individually develop practice concentrations within adult education.

Recommended Courses for Practice Concentrations

<i>Community Education</i>	Credits
ADED 771 Program Development in Community Education	3
ADED 772 Program Management in Community Education	3
ADED 711 Gerontology	3
ADED 712 Developmental Adult Education	3
One Approved Elective	3
 <i>Higher Education</i>	
ADED 776 Principles of College Teaching	3
ADED 714 The Community College	3
ADED 778 Student Personnel Services	3
ADED 773 Leadership	3
One Approved Elective	3
 <i>Human Resource Development</i>	
ADED 710 Foundations of Human Resource Development	3
CUIN 612 Instructional Design 3	
CUIN 714 Instructional Technology Services for Business and Industry	3
TECH 670 Introduction to Workplace Training and Development	3
TECH 671 Methods and Techniques of Workplace Training and Development	3
 <i>Instructional Technology</i>	
CUIN 742 Instructional Design	3
CUIN 617 Computers in Education	3
Elective (3)	
Elective (3)	
One Elective Below:	
CUIN 716 Media Center Management	3
CUIN 742 Instructional Design	
 Course Offerings in Adult Education	
ADED 700 History and Philosophy of Adult and Continuing Education	3 (3-0)
ADED 701 Organization, Administration and Supervision of Adult/Continuing Education Programs	3 (3-0)
ADED 702 Practicum and Seminar in Adult Education	3 (1-4)
ADED 703 Seminar on Contemporary Issues in Adult Continuing Education	3 (3-0)
ADED 704 Independent Study	3 (3-0)
ADED 705 Thesis Research in Adult Education	6 (6-0)
ADED 706 Special Problems in Adult Education	3 (3-0)
ADED 707 Foundations of Adult Education	3 (3-0)
ADED 708 Methods in Adult Education	3 (3-0)
ADED 709 Adult Development and Learning	3 (3-0)
ADED 710 Foundations of Human Resource Development	3 (3-0)
ADED 711 Social Gerontology	3 (3-0)
ADED 712 Developmental Adult Education	3 (3-0)

ADED 713	Literacy in the Black Diaspora	3 (3-0)
ADED 714	The Community College and Postsecondary Education	3 (3-0)
ADED 715	Women in Adult Education	3 (3-0)
ADED 716	Qualitative Research in Adult Education and Continuing Education	3 (3-0)
ADED 759	Computer Applications in Adult Education	3 (3-0)
ADED 771	Program Development: Community Education	3 (3-0)
ADED 772	Program Management: Community Education	3 (3-0)
ADED 773	Leadership	3 (3-0)
ADED 774	The Changing Environment of Human Resources Development	3 (3-0)
ADED 775	Learning Interventions for Human Resources Development	3 (3-0)
ADED 776	Principles of College Teaching	3 (3-0)
ADED 777	Seminar in Higher Education	3 (3-0)
ADED 778	Student Personnel Services	3 (3-0)
ADED 779	Technical Education in Community Junior Colleges	3 (3-0)
ADED 785	A Independent Readings in Education I	1 (0-2)
ADED 786A	Independent Readings in Education II	2 (0-4)
ADED 787A	Independent Readings in Education III	3 (0-6)
ADED 790A	Seminar in Education Problems	3 (3-0)

COURSE DESCRIPTIONS IN ADULT EDUCATION

ADED-700. History and Philosophy of Adult and Continuing Education Credit 3 (3-0)

This is a study of historical and philosophical foundations and thought utilized in the analysis of adult education teaching and learning. The evolution of adult education as a discipline is studied from a multicultural perspective.

ADED-701. Organization, Administration and Supervision of Adult/Continuing Education Programs Credit 3 (3-0)

This course is an examination of theories, concepts and practices as they relate to administrative functions: planning, organizing, staffing, financing, motivating, decision-making, evaluating and delegating in an Adult Education organization.

ADED-702. Practicum and Seminar in Adult Education Credit 3 (1-4)

This course engages participants in a supervised field experience with an agency, business, institution or organization, to enable praxis of adult education theory and methodology. The seminar provides for shared reflection, integration, and discussion of theoretical, methodological implementation and experiences. The practicum experience consists of (50) clock hours. This course is graded as a pass/fail. Prerequisites: Twenty-one (21) graduate credit hours including 18 hours of professional core courses, or permission of instructor.

ADED-703. Seminar on Contemporary Issues in Adult Continuing Education Credit 3 (3-0)

This course is integrative in nature, thereby offering the student an opportunity to synthesize

ADED-704. Independent Study Credit 3 (3-0)

This course permits a participant to develop and execute a learning contract with the instructor to analyze a problem in adult education through supervised study, outside the classroom setting. The problem may be selected from the scholarly literature of adult education or the professional workplace. Prerequisites: Permission of the instructor.

ADED-705. Thesis Research in Adult Education Credit 6 (6-0)

Original graduate level research in adult education is carried out by the adult learner under the supervision of the thesis research committee chairperson and leading to completion of the Master's Thesis. This course is available only to thesis option participants. This course is graded as pass/fail. Prerequisites: Thirty (30) graduate credit hours including ADED 716 or HDSV 770 or comparable research design course, or permission of the instructor.

ADED-706. Special Problems in Adult Education Credit 3 (3-0)

Special topics, individual and group study projects, research, workshops, seminars, travel study tours and organized visitations in areas of adult education planned and agreed upon by

participating students may be included in this course.

ADED-707. Foundations of Adult Education

Credit 3 (3-0)

This course will introduce and address the philosophical, sociological and psychological foundations of adult education, and develop a view of the subject as a broad, diverse, and complex field of study, research, and professional practice. Students will survey many institutions, programs, and individual activities. The range of methods and materials used to enable adults to learn will be discussed.

ADED-708. Methods in Adult Education

Credit 3 (3-0)

This course addresses adult education methodology and learning in formal, non-formal, and informal settings. Attention is given to adult education philosophical perspectives and teaching styles and their implications for methodology.

ADED-709. Adult Development and Learning

Credit 3 (3-0)

The social and psychological contexts of learning, motivation and educational participation will be examined. Major theories of adult development and learning, and their implications for professional practice will be explored through readings, small group and whole class discussion, and inquiry team projects. This course is appropriate for any educators and human services professionals who work with adults including college, university, and other postsecondary educators and counselors, adult secondary educators, community services providers, trainers and human resource developers.

ADED-710. Foundations of Human Resource Development

Credit 3 (3-0)

Human Resource Development (HRD) is concerned with the human resources within both public and private sector organizations, and is defined as the integrated use of employee training and development, organization development, and career development, to improve individual, group, and organizational effectiveness in attaining strategic goals and objectives. This course addresses concepts, practices, and issues in HRD with a focus on workplace learning organizational analysis.

ADED-711. Social Gerontology

Credit 3 (3-0)

This is the study of cultural, sociological and economic factors affecting older adults and their implications for adult education practice.

ADED-712. Developmental Adult Education

Credit 3 (3-0)

This course surveys the complex and growing field of developmental adult education and will include topics relevant to collegiate remedial education, adult literacy, basic and secondary education. English as a second language, and working with the learning disabled adult.

ADED-713. Literacy in the Black Diaspora

Credits 3(3-0)

This is an historical overview of literacy excellence and achievements evolving with the African adult. This cultural reality provides a contextual frame for the study of literacy initiatives within the United States and the Black Diaspora.

ADED-714. The Community College and Postsecondary Education

Credit 3 (3-0)

This is a study of the purposes, organization, functions, current trends and historical evolution of the comprehensive community college, and its role within adult, community and higher education. The North Carolina Community College System is emphasized.

ADED-715. Women in Adult Education

Credits 3(3-0)

This course examines the progression of women professionals in the adult education discipline within a cultural and socio-political context. The emphasis is placed on initial exclusion, marginalization, and evolving participation, scholarship and leadership.

- ADED-716. Qualitative Research in Adult and Continuing Education** **Credits 3(3-0)**
 This course presents an overview of qualitative research methods. Learners are introduced to various qualitative research methods such as historical analysis, case study methods, life histories and ethnography. Data collection and analysis techniques are studied and utilized to present a research project.
- ADED-759. Computer Applications in Adult Education** **Credit 3 (3-0)**
 Experiences will be provided in various computer and software application for adult and higher education.
- ADED-771. Program Development: Community Education** **Credit 3 (3-0)**
 This course is a study of community needs assessment, community program design, program budgeting, grant writing, planning, and infusion of education that is multicultural into the community education curriculum.
- ADED-772. Program Management: Community Education** **Credit 3 (3-0)**
 This course is the study of organization and governance of community education, program implementation, direction, supervision and evaluation.
- ADED-773. Leadership** **Credit 3 (3-0)**
 This course introduces the adult learner to leadership theories, styles, ethics, values, principles, and perspectives. Case studies and other methods are used to examine leadership situations as a means of demonstrating and exercising practical applications of the concepts studied.
- ADED-774. The Changing Environment of Human Resource Development** **Credit 3(3-0)**
 This course examines the organization as a system influenced by external and internal environmental factors. Selected theories of organizational behavior, organizational culture and organizational change will be examined. Learners will develop an in-depth knowledge of the dynamic environment in which the human resource development professional operates. Prerequisites: ADED 710 Foundations of Human Resource Development or the permission of the instructor.
- ADED-775. Learning Interventions for Human Resource Development** **Credits 3(3-0)**
 Typical programs and learning supports provided in public and private sector workplaces will be examined. Human Resource Development interventions that support employee learning, including needs assessment, implementation and evaluation, will be practiced and analyzed. Prerequisites: ADED 710 Foundations of Human Resources Development or the permission of the instructor.
- ADED-776. Principles of College Teaching** **Credit 3 (3-0)**
 This course uses an exploratory approach to the framework and mechanics required to teach successfully at the college level. It addresses skills, methods, course development and syllabus design, the evaluation of learning, diversity appreciation, creativity and the integration of technology, and trends in distance education.
- ADED-777. Seminar in Higher Education** **Credit 3 (3-0)**
 This course is a synthesis of current research in higher education relating to administration, curriculum, and faculty development.
- ADED-778. Student Personnel Services** **Credit 3 (3-0)**
 This course is an analysis of student development programs in post-secondary institutions, including pre-admission; education; vocational and personal counseling; career guidance services; attitude and interest assessment; student affairs, rights, and responsibilities and financial aid.
- ADED-779. Technical Education in Community Junior Colleges** **Credit 3 (3-0)**
 This course offers techniques in identifying community needs and in planning curricula and courses for technical/vocational education.
- ADED-785A Independent Readings in Education I** **Credit 1 (0-2)**
 This course includes individual study and selected readings in consultation with an instructor. Prerequisites: 24 hours of graduate credit.

ADED-786A Independent Readings in Education II **Credit 2 (0-4)**
 This course involves individual study and selected readings in consultation with an instructor.
 Prerequisites: 24 hours of graduate credit.

ADED-787A Independent Readings in Education III **Credit 3 (0-6)**
 This course involves individual study and selected readings in consultation with an instructor.
 Prerequisites: 24 hours of graduate credit.

ADED-790A Seminar in Education Problems **Credit 3 (3-0)**
 This course includes intensive study, investigation, or research in selected areas of adult education.
 Prerequisites: 24 hours graduate credits.

Program of Study for the M.S. in School Counseling		Credit Hours
HDSV 602	Human Development	3
HDSV 610	Counseling Services	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 706	Organization and Administration of Counseling Programs	3
HDSV 712	Counseling School Age Children	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 760	Career Counseling (Lab)	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	Electives	15
		60 Hours

Program of Study for the M.S. in Human Resources (Community/Agency)		Credit Hours
HDSV 602	Human Development	3
HDSV 610	Counseling Services	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 710	Community/Agency Counseling	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 736	Multicultural Counseling	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 760	Career Counseling (Lab)	3
HDSV 763	Family Counseling (Lab)	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	Electives	15
		60 Hours

Program of Study for the M.S. in Human Resources (Rehabilitation Counseling)		Credit Hours
HDSV 602	Human Development	3
HDSV 612	Foundations of Rehabilitation Counseling	3
HDSV 650	Theories in Counseling	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 736	Multicultural Counseling	3
HDSV 738	Psychological Aspects of Disability	3

HDSV 740	Appraisal	3
HDSV 743	Medical Aspects of Disability	3
HDSV 750	Group Counseling (Lab)	3
HDSV 760	Career Counseling (Lab)	3
HDSV 764	Case Management	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research	3
HDSV 775	Job Development and Placement	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
		48 HOURS

Rehabilitation Administration Concentration

TECH 67	Method and Techniques for Workplace Training and Development	3
BUAD 730	Human Resources Management	3
BUAD 731	Staffing	3
BUAD 733	Compensation and Benefits	3

Course Offerings in Counseling

		Credit
HDSV 602	Human Development	3 (3-0)
HDSV 610	Counseling Services	3 (3-0)
HDSV 612	Foundations of Rehabilitation Counseling	3 (3-0)
HDSV 630	Statistics and Research Methodology	3 (3-0)
HDSV 640	Professional Orientation and Ethics in Counseling	3 (3-0)
HDSV 650	Theories of Counseling	3 (3-0)
HDSV 706	Organization and Administration of School Counseling Programs	3 (3-0)
HDSV 711	Human Resource Counseling	3 (3-0)
HDSV 712	Counseling School Age Children	3 (3-0)
HDSV 721	Independent Study	3 (3-0)
HDSV 735	Counseling Methods (Lab)	3 (3-0)
HDSV 736	Multicultural Counseling	3 (3-0)
HDSV 738	Psychological Aspects of Disability	3 (3-0)
HDSV 739	Community/Agency Counseling	3 (3-0)
HDSV 740	Appraisal	3 (3-0)
HDSV 743	Medical Aspects of Disability	3 (3-0)
HDSV 750	Group Counseling (Lab)	3 (3-0)
HDSV 751	Special Topics in Counselin	3 (3-0)
HDSV 759	Substance Abuse Counseling	3 (3-0)
HDSV 760	Career Counseling (Lab)	3 (3-0)
HDSV 763	Family Counseling (Lab)	3 (3-0)
HDSV 764	Case Management	3 (3-0)
HDSV 765	Practicum (Lab)	3 (1-3)
HDSV 770	Applied Research in Counseling	3 (2-2)
HDSV 775	Job Development and Placement	3 (3-0)
HDSV 780	Internship I	3 (0-6)
HDSV 790	Internship II	3 (0-6)

COURSE DESCRIPTIONS IN COUNSELING

- HDSV-602. Human Development** **Credit 3 (3-0)**
This course is an examination of human psychological development through the life span.
- HDSV-610. Counseling Services** **Credit 3 (3-0)**
Those aspects of counseling as they apply to school, community, and business settings will be covered in this course.
- HDSV-612. Foundations of Rehabilitation Counseling** **Credit 3 (3-0)**
This course will explore the history and philosophy of rehabilitation, legislation affecting individuals with disabilities, organizational structure of the rehabilitation systems, and the rehabilitation counseling practice.
- HDSV-640. Professional Orientation and Ethics in Counseling** **Credit 3 (3-0)**
Ethics, standards, and credentialing for professional counselors are presented in this course.
- HDSV-650. Theories of Counseling** **Credit 3 (3-0)**
This course is an introduction to the primary theories and techniques in the field of counseling and their underlying components. Prerequisites: HDSV 602, 610, 612
- HDSV-706. Organization and Administration of School Counseling Programs** **Credit 3 (3-0)**
This course is a study of the organization and implementation of guidance services in schools. Prerequisite: HDSV 610, 640
- HDSV-711. Overview of Human Resources Management** **Credit 3 (3-0)**
This course provides an overview of various aspects of Human Resources management.
- HDSV-712. Counseling School Age Children** **Credit 3 (3-0)**
This course examines how counselors can be effective in addressing the developmental, mental, and psychological needs of elementary, middle, and high school students. Prerequisite: HDSV 650.
- HDSV-721. Independent Study** **Credit 3 (3-0)**
With the supervision of an approving professor, a student may carry out a special project of particular interest, and with appropriate relationship to his counseling specialization. Students must apply for and obtain approval of the supervising professor and the department chairperson one semester before registering for this course. The work of the course must be submitted in the form of a written report.
- HDSV-735. Counseling Methods** **Credit 3 (3-0)**
The fundamentals of general counseling skills will be addressed as a foundation for further study. This course includes laboratory experiences for the observation and application of counseling skills. Prerequisite: HDSV 650.
- HDSV-736. Multicultural Counseling** **Credit 3 (3-0)**
This course provides an overview of issues and trends for counselors in a diverse society. Prerequisites: HDSV 650
- HDSV-738. Psychosocial Aspects of Disability** **Credit 3 (3-0)**
This course explores the social and psychological adjustments of disability, and examines attitudes, feelings, and responses toward persons with disabilities. *Prerequisite: HDSV 610 or HDSV 612*
- HDSV-739. Community/Agency Counseling** **Credit 3 (3-0)**
Counseling delivery systems and procedures found in community/agency settings will be examined in this course. Prerequisite: HDSV 640.

- HDSV-740. Appraisal** **Credit 3 (3-0)**
 The student will be introduced to evaluation and assessment tools, including relevant statistics and computer applications. Prerequisite: HDSV 612, 640
- HDSV-741. Assessment** **Credit 3 (3-0)**
 The medical and psychosocial aspects of disabilities, evaluation approaches, techniques interpretation, available resources, and vocational assessment will be addressed in this course. Prerequisite: HDSV 630
- HDSV-743. Medical Aspects of Disability** **Credit 3 (3-0)**
 This course is an orientation to the characteristics of a range of medical impairments and their vocational implications. It explores medical terminology, common diagnostic procedures, and the role of health professionals. *Prerequisite: Prerequisite: HDSV 610 or HDSV 612*
- HDSV-750. Group Counseling** **Credit 3 (3-0)**
 Theories, techniques, and procedures appropriate for counseling groups will be included, as well as topics to build understanding of group development and dynamics. This course includes laboratory experiences for observation and application of group counseling skills. Prerequisite: HDSV 735.
- HDSV-751. Special Topics in Counseling** **Credit 3 (3-0)**
 Topics in various areas of counseling will be selected and announced by the professor. Prerequisite: HDSV 735.
- HDSV-759. Substance Abuse Counseling** **Credit 3 (3-0)**
 This course will examine the impact of chemical dependency and abuse on the development of individuals, the functioning of families and the productivity of the workforce. Comprehensive ways of conceptualizing and treating substance abuse will be discussed. Prerequisites: HDSV 650.
- HDSV-760. Career Counseling** **Credit 3 (3-0)**
 This course includes career development theories, applied and related counseling procedures and technological applications. This course includes laboratory experiences for observation of and practice in career counseling. Prerequisite: HDSV 735.
- HDSV-763. Family Counseling** **Credit 3 (3-0)**
 This course will introduce major theories of family counseling, including family systems therapy. Experiential, structural, and functional techniques of family counseling and assessment will be addressed. Prerequisite: HDSV 735.
- HDSV-764. Case Management** **Credit 3 (3-0)**
 Case management process (including case finding, service coordination, referral to and utilization of the other disciplines and client advocacy), planning for the provision of independent living services, vocational rehabilitation services, computer applications, and technology for caseload management will be covered in this course. Prerequisite: HDSV 612.
- HDSV-765. Practicum** **Credit 3 (1-4)**
 This is a laboratory course in which studies will engage in supervised practice in the use of counseling skills. Prerequisites: HDSV 640, 750 or 743 and 750.
- HDSV-770. Applied Research** **Credit 3 (2-2)**
 A research report of a technical nature must be produced using skills acquired in HDSV 630. The written report will be under the supervision of the instructor. A technical oral presentation will be required. Prerequisite: HDSV 740.
- HDSV-775. Job Development and Placement** **Credit 3 (3-0)**
 This course will explore strategies for job development, and placement for individuals with disabilities. Prerequisite: HDSV 612.

HDSV-780. Internship I**Credit 3 (0-6)**

This course requires three hundred (300) clock hours of supervised internship in an appropriate field placement. Students must apply to take this course one semester before enrollment. Class meetings will be scheduled and announced by the professor. Individual conferences will be required. Prerequisites: HDSV 765 and all professional core courses as specified by track.

HDSV-790. Internship II**Credit 3 (0-6)**

Three hundred (300) clock hours of advanced supervised practice in an appropriate counseling setting is required. Students must apply to take this course one semester before placement. Class meetings will be scheduled and announced by the professor. Individual conferences will be required. Prerequisites: HDSV 765, 780 and all professional core courses as specified by track.

**Exceptions: Prior professional courses except HDSV 759, 763, and 770*

All major courses must be taken in the counseling program here at NORTH CAROLINA A&T State University.

All “provisionally admitted” students must be reviewed after 9 hours of course work and no additional courses will be given until an “unconditional” application has been submitted by the student, reviewed and accepted by the counseling faculty.

Master of School Administration Degree Program

Principal Licensure

42 Credit Hours Required

Required Courses

Course	Description	Credit
MSA 770	Research and Inquiry	3 (3-0)
MSA 771	Diversity Issues in Administration	3 (3-0)
MSA 772	Administration, Management and Supervision	3 (3-0)
MSA 773	Issues in Educational Administration	3 (3-0)
MSA 774	Curriculum and Instructional Leadership	3 (3-0)
MSA 775	Advanced Technology for Administrators	3 (3-0)
MSA 776	Law, Policy and Politics	3 (3-0)
MSA 777	Ethical and Societal Aspects of Leadership	3 (3-0)
MSA 778	The Principalship	3 (3-0)
MSA 779	Strategic Planning and Problem Solving	3 (3-0)
MSA 780	Internship Seminar I	3 (3-0)
MSA 781	Internship Practicum I	3 (3-0)
MSA 782	Internship Seminar II	3 (3-0)
MSA 783	Internship Practicum II	3 (3-0)

Comprehensive Exam: Successful completion of the comprehensive exam will be required prior to enrollment in the internship and should be taken the final semester of formal coursework. The exam will consist of both written and oral presentations to the faculty. Students will be presented with a case study and are expected to integrate and apply concepts and information from core courses and clinical experiences.

Internship Seminar and Practicum

Seminar topics may include:

- Legal Issues
- Special Education
- Personnel Management
- Due process in student and staff relationships
- Strategies for building parent and community relationships
- Data collection and analysis
- Creating Safe and secure school environments
- Professional development for staff
- Selecting and managing instructional technology

Leadership Portfolio

Each candidate must develop a leadership portfolio that provides evidence of competence in each National, State, and Institutional Standard. The portfolio will document evidence of an intern's reflection on individual growth with respect to knowledge, skills, and professional perspectives in each standard.

State Licensure Examination

The School Leaders Licensure Assessment is required for the State of North Carolina. It must be taken and passed during the internship year prior to graduation.

Course Descriptions in School Administration

Students are enrolled in cohort groups and move thru the sequence of courses together.

MSA 770. Research and Inquiry Credit 3 (3-0)

This course will examine the quantitative and qualitative research methodologies appropriate to school settings and the evaluation of research, data analysis, and its application to schools. (Fall, Spring, and Summer)

MSA 771. Diversity Issues in Administration Credit 3 (3-0)

This course will focus on skills leaders need to successfully deliver programs for diverse student populations. Diverse learning in a pluralistic society and content appropriate strategies will be addressed. (Fall, Spring, and Summer)

MSA 772. Administration, Management, and Supervision Credit 3 (3-0)

This course in administration of K-12 schools will focus on (1) formal and informal organizational structures, concepts, and practices, (2) the management process, (3) administrative and supervisory functions with particular reference to personnel, and (4) program and fiscal management. (Fall, Spring, and Summer)

MSA 773. Issues in Educational Administration Credit 3 (3-0)

This course will focus on current education issues and administrative organization of schools, federal-state-local contexts, accountability issues, school finance, role of technology as both an instructional and administrative tool, building consensus, communicating effectively, and developing collaborative skills will be included. (Fall, Spring, and Summer)

MSA 774. Curriculum and Instructional Leadership Credit 3 (3-0)

This course will focus on the application of current effective theories of learning and research on classroom instruction. Curriculum planning based on state and national standards, diversity issues, and use of instructional technology and assessment strategies will be addressed. Leadership styles and models to improve curriculum and instruction through classroom observation and assessment of teacher delivery will be included. (Fall, Spring, and Summer)

MSA 775. Technology for School Administrators Credit 3 (3-0)

The use of technology for curriculum management, student management, fiscal management, decision-making, and other administrative applications will be covered in this course. (Fall, Spring, and Summer)

MSA 776. Law, Policy, and Politics of Education Credit 3 (3-0)

This course will cover the influence of the laws, educational policies, and power structures of communities on the goals and operations of schools. State statutes, administrative policies and regulations, court decisions regarding public school personnel, and appropriate application of legal principles will be discussed. (Fall, Spring, and Summer)

MSA 777. Ethical and Societal Aspects of Educational Leadership Credit 3 (3-0)

This course will provide an examination of the social, cultural, political, economical, and philosophical contexts from which the current issues that affect schools and schooling have evolved. (Fall, Spring, and Summer)

MSA 778. The Principalship Credit 3 (3-0)

This principalship course will examine different management perspectives of school operations, organizations, and team leadership. The relationship of schools to other community agencies, supervision, instructional leadership, personnel administration, and communication will be discussed. (Fall, Spring, and Summer)

MSA 779. Strategic Planning and Problem Solving **Credit 3 (3-0)**

This course will focus on components of strategic planning and problems solving including research and best practices. Problem-solving processes will emphasize retrieving, assessing, evaluating, and synthesizing research as applied to educational programs. (Fall, Spring, and Summer)

MSA 780. Internship Seminar I **Credit 3 (1-2)**

The internship seminar is conducted once a week during the full-time internship. This seminar complements field activities and provides interns the opportunity to share experiences, develop concepts, and broaden their knowledge of school administration. Students will develop case studies, and portfolios to demonstrate acquisition of skills. Co-requisite: MSA 781 Internship Practicum I. (Fall, Spring, and Summer)

MSA 781. Internship Practicum I **Credit 3 (0-6)**

Each student will complete a semester internship in a public educational setting with joint supervision by a university faculty member and a cooperating mentor for each individual intern. The internship is the culminating experiences in the preparation of school administrators. Co-requisite: MSA 780 Internship Seminar I. (Fall, Spring, and Summer)

MSA 782. Internship Seminar II **Credit 3 (1-2)**

The internship seminar is conducted once a week during the full-time internship. This seminar complements field activities and provides interns the opportunity to share experiences, develop concepts, and broaden their knowledge of school administration. Students will develop case studies, and portfolios to demonstrate acquisition of skills. Co-requisite: MSA 783 Internship Practicum I. (Fall, Spring, and Summer)

MSA 783. Internship Practicum II **Credit 3 (0-6)**

Each student will complete a semester internship in a public educational setting with joint supervision by a university faculty member and a cooperating mentor for each individual intern. The internship is the culminating experiences in the preparation of school administrators. Co-requisite: MSA 782 Internship Seminar I. (Fall, Spring, and Summer)

Gladys G. Shelton, Chairperson
102 Benbow Hall
(336) 334-7850

OBJECTIVES

The objectives of the graduate program in Food and Nutritional Sciences are:

1. To develop the basic knowledge and skills necessary to undertake research in the Food and Nutritional Sciences and other related areas.
2. To develop competencies to work as food and nutrition specialists in education, or with other community nutrition agencies and food industries.
3. To obtain theoretical and experimental competencies necessary to pursue additional graduate studies or obtain professional degrees.

DEGREE OFFERED

Master of Science - Food and Nutritional Sciences

GENERAL PROGRAM REQUIREMENTS

For admission, students in the graduate program in Food and Nutritional Sciences must have an earned baccalaureate degree in Food and Nutrition from an accredited undergraduate institution and have an overall grade point average of 2.6. Non-food and nutrition majors (i.e., Chemistry, Biochemistry, Biology, Animal and Plant Sciences, Physiology, or other related science disciplines) are encouraged to apply but students are required to clear the course deficiencies after enrollment. A minimum of six (6) hours or more of Food and Nutritional Sciences courses are required to address these deficiencies. The Test of English as a Foreign Language (TOEFL) is required for foreign students. The Graduate Record Examination (GRE) is not required for admission into the program at this time.

The Masters program in Food and Nutritional Sciences offer students two (2) options: thesis and non-thesis. The thesis option requires that each student submit a thesis based on research related to Nutrition or Food Science. The non-thesis option requires students to take in addition to the curriculum a minimum of six (6) extra credit hours. These credit hours must be at the graduate level.

OTHER REQUIREMENTS

All applicants are required to take a Qualifying Examination in Food and Nutritional Sciences or take two basic Food and Nutritional Sciences courses. The test must be taken preferably prior to the registration for graduate courses or by the end of the first semester of the graduate work. The student may take one basic Food Science course and one Nutrition course each, and make a grade of B or better. Admission to candidacy for the M.S. in Food and Nutritional Sciences requires the satisfactory completion of the Qualifying Examination, a minimum overall average of 3.0 in at least nine (9) semester hours of graduate work at NCA&TSU, and removal of all deficiencies in undergraduate preparation.

A final Comprehensive Examination in Food and Nutritional Sciences can be taken only if a student has completed all course work and maintained a 3.0 grade point average in graduate courses at the 600 level or above. At least fifty percent of the courses counted in the work towards the Master's degree must be designated for graduate students only.

The student must complete the Departmental Qualifying Examination, the Comprehensive Examination, satisfactory presentation and defense of the thesis (thesis option) and submission to the graduate office or completion of practicum (non-thesis) in order to be approved for graduation.

CAREER OPPORTUNITIES

A degree in this area prepares students to enter careers in such areas as research, quality control and management for food industries, local, state and federal agencies. Other career options may include college and junior college teaching, community nutrition, dietetics and extension service.

A. Thesis Option - Suggested Curriculum Guide

Requirements:

1. Twelve-Thirteen (12-13) semester hours of Food and Nutrition courses.
HEFS 730 - Nutrition and Disease 3 credits
HEFS 735 - Experimental Foods (4 credits) OR
HEFS 631 - Food Chemistry (3 credits) 3-4 credits
HEFS 736 - Research Methods Food and Nutrition 4 credits
HEFS 744 - Seminar in Food and Nutrition 2 credits
HEFS 788 - Comprehensive Examination 0 credit
2. In addition to the above core courses three (3) hours of 3 credits statistics numbered 600 or above are required.
3. Six (6) semester hours in Food and Nutrition and related 6 credits areas are required.
4. Three (3) semester hours of advanced Biochemistry or 3 credits equivalent numbered 600 or above.
5. Three (3) semester hours of suggested electives 3 credits
6. HEFS 739 - Thesis Research 3 credits
30-31 credit hours

B. Non-Thesis Option - Suggested Curriculum Guide

Requirements:

1. Twelve-Thirteen (12-13) semester hours of Food and Nutrition courses.
HEFS 730 - Nutrition and Disease 3 credits
HEFS 735 - Experimental Foods (4 credits) OR
HEFS 631 - Food Chemistry (3 credits) 3-4 credits
HEFS 736 - Research Methods Food and Nutrition 4 credits
HEFS 744 - Seminar in Food and Nutrition 2 credits
HEFS 745 - Practicum in Food and Nutrition 3 credits
HEFS 788 - Comprehensive Examination 0 credit
2. In addition to the above core courses three (3) hours of 3 credits statistics numbered 600 or above are required.
3. Twelve (12) semester hours in Food and Nutrition and 12 credits related areas are required.
4. Three (3) semester hours of advanced Biochemistry 3 credits numbered 600 or above or equivalent.
5. Three (3) semester hours of suggested electives. 3 credits

COURSES - FOOD AND NUTRITIONAL SCIENCES AND RELATED AREAS

HEFS 601	Quantity Food
HEFS 630	Advanced Nutrition
HEFS 631	Food Chemistry
HEFS 632	Maternal and Developmental Nutrition
HEFS 635	Introduction to Research Methods in Food and Nutrition
HEFS 636	Food Promotion
HEFS 637	Special Problem in Food, Nutrition or Food Science
HEFS 638	Sensory Evaluation
HEFS 640	Geriatric Nutrition
HEFS 641	Current Trends in Food Service
HEFS 643	Food Preservation
HEFS 648	Community Nutrition
HEFS 650	International Nutrition
HEFS 651	Food Safety and Sanitation
HEFS 652	Diet Therapy
HEFS 653	Food Biotechnology
HEFS 679	Nutrition Education
HEFS 715	Trace Elements and Nutrition
HEFS 730	Nutrition and Disease
HEFS 733	Nutrition during the Growth and Development
HEFS 734	Nutrition Education

HEFS 735	Experimental Foods
HEFS 736	Research Methods in Food and Nutrition
HEFS 739	Thesis Research
HEFS 740	Community Nutrition
HEFS 742	Food Culture: Nutrition Anthropology
HEFS 744	Seminar in Food and Nutrition
HEFS 745	Practicum in Food and Nutrition

Suggested Elective Courses

HEFS 606	Cooperative Extension
HEFS 607	Cooperative Extension Field Experience
HEFS 608	Teaching Adults and Youth in Out-of-School Settings
ANSC 615	Selection of Meat and Meat Products
ANSC 617	Physiology of Reproduction of Farm Animals
BIOL 630	Molecular Genetics
CHEM 651	General Biochemistry
COMP 600	Special Topics in Computer Science
CUIN 617	Computer in Education
SOCI 617	Research Methods II
CUIN 776	Independent Reading in Education II
CUIN 777	Independent Reading in Education III
CUIN-S- 790	Seminar in Education Problem

COURSES WITH DESCRIPTION IN HUMAN ENVIRONMENT AND FAMILY SCIENCES

Food and Nutritional Sciences Advanced Undergraduate and Graduate Courses

HEFS-601. Quantity Foods **Credit 4 (1-6)**
The application of principles of cookery to the preparation and service of food for group feeding with emphasis on menu planning, work schedules, cost and portion control, distribution and service are implemented in a laboratory setting. Prerequisites: HEFS-130, 246, 344, AGEC-446.

EFS-630. Advanced Nutrition **Credit 3 (3-0)**
Intermediate metabolism and interrelationships of organic and inorganic food nutrients in human biochemical functions. Prerequisites: HEFS-337 and CHEM-251, 252 or equivalent.

HEFS-631. Food Chemistry **Credit 3 (2-2)**
A study of the chemical, biochemical and physical properties of components of basic raw foods and behavior of the components including non-microbial changes during processing and storage. Prerequisites: HEFS-236, CHEM-106, 107 and 251.

HEFS-632. Maternal and Lifespan Nutrition **Credit 3 (3-0)**
This course emphasizes the energy and nutrient requirements and feeding practices for stages of the life span. The influence of nutrition on growth and development is discussed. The nutritional quality of food, physiological development, growth assessment, dietary evaluation and nutrition assessments for various stages of the lifespan are covered. Prerequisites: HEFS-332, 337 or instructor's permission.

HEFS-633. Food Analysis **Credit 3 (1-4)**
Fundamental chemical, physical and sensory aspects of food composition as they relate to physical properties, acceptability and nutritional values of foods. Prerequisites: CHEM-102, 112, HEFS-236.

HEFS-635. Introduction to Research Methods in Food and Nutrition **Credit 3 (0-6)**
Laboratory experiences in the use of methods applicable to food and nutrition research. Prerequisite: Consent of the instructor.

- HEFS-636. Food Promotion** **Credit 4 (1-6)**
 A course which provides experiences in the development and testing of recipes. Opportunities will be provided for demonstrations, writing and photography with selected business.
- HEFS-637. Special Problems in Food and Nutrition** **Credit 3 (0-6)**
 Independent study and/or experiences in food and/or nutrition. Prerequisite: Admission by instructor.
- HEFS-638. Sensory Evaluation** **Credit 3 (2-2)**
 A study of the color, flavor, aroma and texture of foods by the use of sensory evaluation methods. Prerequisites: HEFS-236, HEFS-337.
- HEFS-640. Geriatric Nutrition** **Credit 3 (3-0)**
 Multidisciplinary approaches to geriatric foods, nutrition and health problems. Evaluation of nutritional status and nutrition care of the elderly is emphasized. Field experience: nursing home and other community agencies. Prerequisite: HEFS-337 or 439.
- HEFS-641. Current Trends in Food Science** **Credit 3 (3-0)**
 Recent developments in food science and their implications for food scientists, nutritionists, dietitians and other professionals in the food industry and related professions.
- HEFS-643. Food Preservation** **Credit 3 (2-2)**
 A study of current methods of preserving foods - canning, freezing, dehydration, radiation, and fermentation. Prerequisite: HEFS-236 or equivalent.
- HEFS-645. Special Problems in Food Administration** **Credit 2 (0-4)**
 Individual work on special problems in food administration.
- HEFS-648. Community Nutrition** **Credit 3 (3-0)**
 This course provides an introduction and review of major communication and education skills that dietitians and nutritionists use in techniques of interviewing and counseling in community nutrition programs, and materials, methods and goals in planning, assessing, organizing and marketing nutrition for health promotion and preventing diseases. Evaluation of food and nutrition programs at State and Federal level are included. Prerequisite: HEFS-679.
- HEFS-650. International Nutrition** **Credit 3 (3-0)**
 An ecological approach to the study of hunger and malnutrition in technologically developed and developing countries. Focus is on integrated intervention programs, projects, and problems. Opportunities to participate in national and international internships through cooperative arrangements are provided.
- HEFS-651. Food Safety and Sanitation** **Credit 3 (3-0)**
 This course covers practices and procedures for hygienic food handling, processing, sanitation, food safety laws, and implementation of Hazard Analysis Critical Control point (HACCP) system in food processing and food service operations. Emphasis is placed on sanitation management, hazards, standards, and corrective actions for food service operations that are critical control points for food safety. Practical measures for prevention of food borne diseases and the effects of microorganisms, toxins, foreign objectives and physical damage on the safety and quality of foods are discussed. Prerequisite: BIOL-220.
- HEFS-652. Diet Therapy** **Credit 4 (3-2)**
 This course is a study of the principles of nutritional sciences in the treatment and management of nutrition related diseases. Course content includes etiology, prevalence, pathophysiology, biochemical, clinical and nutritional needs and diet modification in the treatment of diseases. Prerequisites: HEFS-130, 337, 630.
- HEFS-653. Food Biotechnology** **Credit 3(1-4)**
 This course covers the impact of biotechnology on food production. It covers classical to modern

day food biotechnology and beyond. Modern day genetic tools, as applied to food biotechnology, will be examined. A major focus will be on the improvement of microbes used in food production by modern biotechnological approaches. Prerequisites: BIOL 220.

HEFS-679. Nutrition Education

Credit 3 (3-0)

This course covers the philosophy, principles, methods and materials involved in nutrition education. Application of nutrition knowledge and skills in the development of the nutrition education curriculum and programs in schools and communities is implemented. Prerequisites: 332, 337; students must be advanced undergraduate or graduate level.

GRADUATE STUDENTS ONLY

HEFS-715. Trace Elements and Nutrition

Credit 3 (3-0)

Physiological functions and requirements of trace minerals as well as the roles of trace minerals in health and disease will be discussed. Prerequisite: HEFS 337.

HEFS-730. Nutrition and Disease

Credit 3 (3-1)

Significance of nutrition in health and disease. Consideration of: (1) the methods of appraisal of human nutritional status to include clinical, dietary, biochemical, and anthropometric techniques; (2) various biochemical parameters used to diagnose and treat disorders; and (3) the role of diet as a therapeutic tool. Prerequisite: HEFS-630 or equivalent.

HEFS-733. Nutrition During Growth and Development

Credit 3 (2-2)

Nutritional, genetical and environmental influences on human growth and development. Prerequisite: HEFS-630 or equivalent.

HEFS-734. Nutrition Education

Credit 3 (2-2)

Interpretation of the results of nutrition research for use with lay groups. Preparation of teaching materials based on research for use in nutrition education programs. Prerequisite: HEFS 337.

HEFS-735. Experimental Foods

Credit 3 (2-2)

Objective and subjective evaluation of food, development and testing of recipes, and experimentation with food. Prerequisite: HEFS-236 or equivalent.

HEFS-736. Research Methods in Food and Nutrition

Credit 4 (2-6)

Experimental procedures in food and nutrition research care of experimental animals, analysis of food, body fluids, and animal tissues. Prerequisite: MATH 224 or equivalent.

HEFS-739. Thesis Research

Credit 3 (0-6)

Research problems in food or nutrition.

HEFS-740. Community Nutrition

Credit 3 (3-0)

Individualized work, team teaching or guest speakers. Application of the principles of nutrition to various community nutrition problems of specific groups (geriatrics, preschoolers, adolescents and expectant mothers). Evaluation of nutrition programs of public health and social welfare agencies at local, state, federal and international levels. Prerequisite: HEFS 337.

HEFS-742. Cultural and Social Aspects of Food and Nutrition

Credit 3 (3-0)

Sociological, psychological, and economical background of ethnic groups and their influence on food consumption patterns, and nutritional status. Prerequisite: HEFS 337.

HEFS-744. Seminar in Food and Nutrition

Credit 2 (2-0)

Required of all graduates in Food and Nutrition.

HEFS-745. Practicum in Food or Nutrition

Credit 3 (0-6)

Field experiences with private or public agencies. Prerequisite: Students must have completed at least 12 credit hours.

HEFS-788 Comprehensive Examination

Credit 0

Student must sign up for this course in the semester that they will take the Comprehensive Examination.

Human Resources Management

Edna J. Ragins, Interim Chairperson
Room 312D, Quiester Craig Hall
(336) 334-7656

OBJECTIVE

The Department of Business Administration offers a program of study leading to the Master of Science in Management degree with a major concentration in Human Resources Management (HRM). The program prepares students and professionals for careers in public and private sector positions in the Human Resources Management function of organizations and managers interested in understanding how to effectively develop and manage human resources.

DEGREE OFFERED

Master of Science in Management – Human Resources Management

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.6 (on a 4.0 scale), and a satisfactory GMAT score. Applicants who do not meet the requirements will be considered on an individual basis. A GPA of 3.0 is required for graduation.

PROGRAM REQUIREMENTS

Students with a variety of undergraduate majors are encouraged to apply. The program is designed to appeal to those who either currently work in industry or desire to affiliate with firms or organizations using cutting-edge tools to deliver their products or services. Students in the program will have a business undergraduate degree and wish to study a particular area in greater depth, or have a non-business degree with the personal or professional interests or experiences that would be enhanced by a high quality graduate program in management education.

The program requires a minimum of 36 semester hours. There is no thesis requirement. Students without an undergraduate business degree will be required to take appropriate foundation courses, which may extend the requirements to 48 semester hours. The program consists of 21 hours of core courses, including one 3-hour elective, and 15 hours of coursework in the major concentration.

The student pursuing the Master of Science in Management with a major concentration in HRM is required to complete a common core of courses consisting of:

ACCT 714 Managerial Accounting & Finance	3 semester hours
BUAD 713 Business Applications Development	3 semester hours
BUAD 715 Quantitative Business Analysis	3 semester hours
BUAD 716 Strategic Marketing	3 semester hours
BUAD 718 Management & Organization Analysis	3 semester hours
ECON 608 Managerial Economics	3 semester hours

ELECTIVE *One course selected from the following:*

BUAD 735 Contemporary Issues in Human Resources Management	3 semester hours
BUAD 736 Human Resources Management Strategy	3 semester hours
Courses in the HRM concentration will consist of the following:	
BUAD 730 Human Resources Management	3 semester hours
BUAD 731 Staffing	3 semester hours
BUAD 732 Training and Development	3 semester hours
BUAD 733 Compensation and Benefits	3 semester hours
BUAD 734 Employee Relations	3 semester hours

Students without an undergraduate business degree will be required to take appropriate foundation courses, which consist of the following.

ACCT 708 Seminar in Financial Concepts	3 semester hours
BUAD 705 Seminar in Business Analysis	3 semester hours
BUAD 712 Foundation of Enterprise Management	3 semester hours
ECON 706 Seminar in Economics	3 semester hours

LIST OF GRADUATE COURSES

Course Description	Credit
ACCT 708 Seminar in Financial Concepts	3
ACCT 714 Managerial Accounting & Finance	3
BUAD 705 Seminar in Business Analysis	3
BUAD 712 Foundation of Enterprise Management	3
BUAD 713 Business Applications Development	3
BUAD 715 Quantitative Business Analysis	3
BUAD 716 Strategic Marketing	3
BUAD 718 Management & Organization Analysis	3
BUAD 730 Human Resources management	3
BUAD 731 Staffing	3
BUAD 732 Training and Development	3
BUAD 733 Compensation and Benefits	3
BUAD 734 Employee Relations	3
BUAD 735 Contemporary Issues in Human Resources Management	3
BUAD 736 Human Resources Management Strategy	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3

COURSES WITH DESCRIPTION IN BUSINESS ADMINISTRATION

BUAD-705. Seminar in Business Analysis **Credit 3 (3-0)**

This course will integrate the statistical and mathematical concepts that are essential for identifying, analyzing, and solving complex business problems. Business applications will involve investment, inventory, and capital budgeting analyses, utilizing computer spreadsheet models and the Visual Basic programming language.

BUAD-712. Foundations of Enterprise Management **Credit 3 (3-0)**

This course provides an understanding of key themes related to successful enterprise management, and discussions of the interpersonal and intellectual skills necessary to contribute to a highly competitive and globalized business environment. Topics include the globalization of commerce, marketing and market systems, competitive strategy, perspectives on legal and ethical business conduct, information technology, and the elements of quality. Individual and team competencies are developed using materials that involve interpersonal skills, problem-solving, and case analysis.

BUAD 713. Business Applications Development **Credit 3 (3-0)**

This course focuses on application development and tools for business solutions. Concepts associated with the design, creation, and implementation of computer programs are studied. Application algorithms are designed using supportive software tools such as flowcharts, pseudocode, and hierarchy charts. Emphasis is placed on the development of applications using systems methods, top-down design, testing, debugging, modularity, and structured techniques to be implemented and maintained in a variety of business environments. This course uses an object-oriented programming language.

BUAD-715. Quantitative Business Analysis **Credit 3 (3-0)**

This course familiarizes students with basic quantitative techniques for decision-making in all business functions. Specific topics will include data collection and presentation; basic descriptive statistics and probability; discrete and continuous probability distributions; confidence intervals; hypothesis testing; business forecasting; linear and multiple regression models; linear, integer, and nonlinear programming; and computer simulation. Emphasis will be on the

application of these techniques for managerial decision-making. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-716. Strategic Marketing **Credit 3 (3-0)**

This course provides in-depth examination of the role of marketing in strategic planning and decision-making. Students develop skills critical to directing business-unit marketing strategy and designing or reengineering a customer-driven organization. The course content emphasizes cases and readings. It also exposes students to emerging issues in marketing strategy including relationship marketing and e-commerce. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-718. Management and Organizational Analysis **Credit 3 (3-0)**

This course is a study of formal organizations as rational, organic, open systems and their behavior in response to an ever-changing, global and domestic environment. It covers macro and micro theories of management and organizations and their application to organizational design and processes. Organizational effectiveness, strategic planning and control, structural designs, leadership, motivation, globalization, and corporate politics and culture are studied through extensive reading, case studies, exploratory research and seminar discussions. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-730. Human Resources Management **Credit 3 (3-0)**

This course provides an overview of the design, administration and evaluation of the human resources function. It looks at conceptual issues, policies and practices used by organizations to attract, develop and retain human resources; and the role of human resources management in organizational effectiveness. Topics include an introduction to the activities of the human resource function: staffing, training and development, performance appraisal, compensation and benefits, employee relations, and legal environment of human resources management, and special issues and challenges in international human resources management. Theories relating to human motivation and behavior are discussed. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-731. Staffing **Credit 3 (3-0)**

This course looks at theory and application methods used in the recruitment and selection of employees. Course topics include job analysis, interviewing and testing methods, selection techniques, legal issues in recruitment and selection, internal and external selection processes including performance appraisal and management, staffing philosophies for international operations, and expatriate repatriation. Prerequisite: BUAD 730.

BUAD-732. Training and Development **Credit 3 (3-0)**

This course explores the theory and practice used for training and developing human resources in organizations. Course content includes identifying training needs, designing and implementing training programs to satisfy individual and organizational goals, and evaluating training program effectiveness. Workforce diversity, theories of organizational and individual learning, career development, change theory and training for international operations are also discussed. Prerequisite: BUAD 730.

BUAD-733. Compensation and Benefits **Credit 3 (3-0)**

This course examines theory and practice in designing and managing compensation and benefit systems in organizations. Issues considered include compensation and benefit systems as vehicles for attracting, motivating, and retaining employees; designing individual and group incentive plans; structuring pension plans; determining wage levels and structures; legal issues and considerations in compensation and benefit administration; and expatriate compensation. Prerequisite: BUAD 730.

BUAD-734. Employee Relations **Credit 3 (3-0)**

This course examines the policies and practices used to promote equitable treatment of employees. Topics include employee health and safety, employee communication, equal opportunity and affirmative action, workforce diversity, employee rights, conflict resolution, industrial relations, and international labor relations. Also includes legal aspects of employee

relations. Prerequisite: BUAD 730.

BUAD-735. Contemporary Issues in Human Resources Management **Credit 3 (3-0)**

This course considers important issues affecting the acquisition and utilization of human resources in a dynamic global environment. Topics vary and depend on the current HRM environment. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-736. Human Resources Management Strategy **Credit 3 (3-0)**

This course focuses on the formulation and implementation of human resources management strategies. Emphasis is placed on the strategic dimensions of recruitment, selection, development and retention of a workforce needed to accomplish organizational strategic objectives. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

Industrial and Systems Engineering

Eui H. Park, Chairperson
419 McNair Building
(336) 334-7780

OBJECTIVE

The Master of Science and Doctor of Philosophy Programs in Industrial Engineering are designed to meet the need for technical and/or managerial specialists in Industrial Engineering. Four areas of concentration (Human-Machine Systems Engineering (HMSE), Management Systems Engineering (MSE), Production Systems Engineering (PSE), and Operations Research and Systems Analysis (ORSA) are being offered.

DEGREE OFFERED

Master of Science - Industrial Engineering
Ph.D. - Industrial Engineering

GENERAL PROGRAM REQUIREMENTS

The program is open to students with a bachelor's degree in a scientific discipline from an institution of recognized standing. Students desiring to enter the program, who do not possess a bachelor's degree in a scientific discipline are required to complete with at least a "B" average, a number of background courses in mathematics, physics and engineering science prior to admission to the graduate program. Students entering the program without a bachelor's degree in Industrial Engineering from an accredited department are required to remove all deficiencies in general professional prerequisites.

Graduate Record Examination scores will be given consideration in making decisions regarding financial assistance.

PROGRAM OPTIONS AND DEGREE REQUIREMENTS

For the Master of Science Program three degree options are available, namely, Thesis, Project and Course-only. The thesis option requires 24 semester hours of course work and 6 hours of thesis culminating in scholarly research work. The project option requires 30 semester hours of course work and 3 hours of project work. Both the thesis and project options require an oral examination and a written report. The Course-only option requires 33 semester hours of course work and a 1 semester hour comprehensive exam. To graduate, a student must maintain a 3.0 grade point average.

The Ph.D. program requires a total of 75 semester hours after the B.S. degree, which includes 18 semester hours of dissertation work. The Ph.D. program offers specialization in Human-Machine Systems Engineering (HMSE), Management Systems Engineering (MSE), and Production Systems Engineering (PSE).

Additional details of requirements for the M.S. and Ph.D. programs in Industrial Engineering are outlined in the Graduate Program Student Handbook available from the department.

List of Courses		Credits
INEN 600	Survey of Industrial Engineering Topics	3
INEN 615	Industrial Simulation	3
INEN 618	Total Quality Improvement	3
INEN 624	Computer-Integrated Design / Manufacturing	3
INEN 625	Industrial Information Systems	3
INEN 632	Robotic Systems and Applications	3
INEN 633	Engineering Law and Ethics	3
INEN 635	Materials Handling Systems Design	3
INEN 648	Biomechanics	3

INEN 655	Production Planning & Scheduling	3
INEN 658	Project Management	3
INEN 664	Systems Safety Engineering and Risk Analysis	3
INEN 665	Human-Machine Systems	3
INEN 675	Design and Analysis of Experiments	3
INEN 685	Selected Topics in Industrial Engineering Var. 1-	3
INEN 694	Special Projects Var. 1-	3
INEN 721	Systems Engineering Models	3
INEN 731	Engineering Cost Control	3
INEN 734	Engineering Organization	3
INEN 735	Human-Computer Interface	3
INEN 742	Linear and Integer Programming	3
INEN 745	Advanced Computer-Integrated Production Systems	3
INEN 812	Advanced Ergonomics	3
INEN 813	Cognitive Systems Engineering	3
INEN 814	Advanced Topics in Human-Machine Systems	3
INEN 821	Multivariate Statistics for Engineering	3
INEN 822	Advanced Systems Simulation	3
INEN 831	Service Sector Engineering	3
INEN 832	Information Technology Management	3
INEN 833	Supply Chain Systems Engineering	3
INEN 841	Linear and Nonlinear Optimization	3
INEN 843	Queuing Theory	3
INEN 844	Reliability and Maintenance	3
INEN 851	Integrated Manufacturing Control Systems	3
INEN 852	Integrated Product and Process Design	3
INEN 853	Enterprise Integration	3
INEN 854	Inventory & Warehouse Systems	3
INEN 885	Advanced Special Topics in Industrial Engineering	3

M.S. level Pass/Fail Courses

INEN 792	Industrial Engineering Master's Seminar	1
INEN 793	Master's Supervised Teaching	3
INEN 794	Master's Supervised Research	3
INEN 796	Master's Project	3
INEN 797	Master's Thesis Var.	1-3
INEN 799	Continuation of Master's Project/Thesis	1

Ph.D level Pass/Fail Courses

INEN 991	Doctoral Qualifying Examination	1
INEN 992	Doctoral Seminar in Industrial engineering	1
INEN 993	Doctoral Supervised Teaching in Industrial Engineering	3
INEN 994	Doctoral Supervised Research in Industrial Engineering	3
INEN 995	Doctoral Preliminary Examination	3
INEN 997	Dissertation Var.	1-3
INEN 999	Continuation of Dissertation	1

COURSE DESCRIPTION Advanced Undergraduate and Graduate

INEN-600. Survey of Industrial Engineering Topics **Credit 3 (3-0)**

This course will introduce topics in the following areas of Industrial Engineering: Engineering Economy, Linear Programming, Production Control, Methods Engineering, and Statistical Process Control. Prerequisite: Senior/Graduate Standing.

INEN-615. Industrial Simulation **Credit 3 (3-0)**

This course addresses discrete-event simulation languages. One general purpose simulation language is taught in depth. The use of simulation in design and improvement of production and service systems is emphasized. Term papers and projects will be required. Prerequisite: Senior/Graduate Study.

INEN-618. Total Quality Improvement **Credit 3 (3-0)**

This course provides a systematic engineering approach to understanding the philosophy and application of Total Quality Improvement (TQI). It also introduces students to Continuous Improvement (C) techniques used by management as a means of improving engineering processes in order to become and remain competitive in the global marketplace. The C1 techniques and concepts this course includes a strategic planning, benchmarking, ISO 9000, teamwork, customer satisfaction, employee involvement, quality tools, and business process reengineering. Design projects are required. Prerequisite: Senior/Graduate Standing.

INEN-624. Computer-Integrated Design / Manufacture **Credit 3 (2-2)**

This course addresses Computer-based tools and techniques for integrated product and process design. Topics include numerical computer-aided design and process planning, group technology, numerical control, computer numerical control, and direct numerical control, rapid response technologies, integrated manufacturing planning, execution, and control and computer-integrated manufacturing. Design projects are required. Prerequisite: Senior/Graduate Standing.

INEN-625. Information Systems **Credit 3 (3-0)**

This course introduces the planning, design, implementation and evaluation of industrial information systems. Analysis and design techniques, organization of data, current software tools, client-server architectures, and current database technologies are presented. The role of information systems in global manufacturing, distribution, and services is addressed. Design projects are required. Prerequisite: Senior/Graduate Standing.

INEN-632. Robotic Systems and Applications **Credit 3 (2-2)**

This course addresses design, analysis, implementation and operation of robotics in production systems. End effectors, vision systems, sensors, stability and control off-line programming, and simulation of robotic systems are covered. Methods for planning robotic work areas are emphasized. Design projects are required. Prerequisite: Senior/Graduate Standing.

INEN-633. Engineering Law and Ethics **Credit 3 (2-2)**

This course introduces engineers to law and ethics. Topics include contract law and practices, product liability, intellectual property and patent law, research and development contracts, environmental law, interstate commerce regulations, labor law, workers' compensation, safety regulations, ethical issues involving conflict of interest, and confidentiality. Prerequisite: Senior/Graduate Standing.

INEN-635. Materials Handling Systems Design **Credit 3 (2-2)**

This course focuses on the design and analysis of materials handling and flow in manufacturing facilities. Principles, functions, equipment and theoretical approaches in materials handling are discussed. Tools for the automation of materials handling are introduced. Design projects are required. Prerequisite: Senior/Graduate Standing.

INEN-648. Biomechanics **Credit 3 (3-0)**

This course covers human biomechanical and physiological behavior during work. Quantitative methods using engineering mechanics principles and computer simulation are emphasized. Prerequisite: Senior/Graduate Standing.

INEN-655. Production Planning & Scheduling **Credits 3 (3-0)**

This course focuses on the design, control and underlying behavior of manufacturing and service systems with emphasis on quantitative and information technology methods. Topic covered in this course include demand forecasting, inventory management, aggregate planning, operations scheduling, Material Requirements Planning and Manufacturing Resource Planning, Just-in-Time, Theory of Constraints and Supply Chain Management. Projects will be required. Prerequisite: Senior/Graduate Standing

INEN-658. Project Management **Credit 3 (3-0)**

This course addresses project proposal preparation, resource and cost estimation, project planning,

organizing and controlling, network diagrams, and computerized project planning systems.
Prerequisite: Senior/Graduate Standing.

INEN-664. Systems Safety Engineering and Risk Analysis **Credit 3 (3-0)**

This course presents the principles and methods of system safety management and risk analysis. Quantitative and qualitative methods and their applications in safety and risk analysis of human-machine systems are emphasized.

INEN-665. Human Machine Systems **Credit 3 (2-2)**

This course emphasizes the application of perceptual, cognitive, and physical ergonomics principles to the design of human-machine systems. Topics covered include physiological limitations, cognitive and perceptual issues, task complexity and the demands on physical/cognitive resources, human-machine system integration, usability and evaluation methods. Design projects are required. Prerequisites: Senior/Graduate Standing in ISE or Consent of Instructor.

INEN-675. Design and Analysis of Experiments **Credit 3 (3-0)**

This course addresses various experimental designs, to analyze data for research projects, process improvements, human factors studies, and surveys. Designs covered include Latin Squares, complete and incomplete block designs, one, two, and three variable factorials, fractional factorials, nested designs, and 2k designs. Suitable laboratory apparatus will be set up to study the effect of design parameters on selected response. Statistical software will be utilized to analyze results. Parametric statistics such as analysis of variance (ANOVA) are introduced. Prerequisite: Senior/Graduate Standing.

INEN-685. Selected Topics in Industrial Engineering Var. **Credit (1-3)**

Selected engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Senior/Graduate Standing.

INEN-694. Special Projects Var. **Credit (1-3)**

Study arranged on a special engineering topic of interest to student and faculty member, who will act as advisor. Topics may be analytical and/or experimental and encourage independent study. Prerequisite: Consent of the instructor.
M.S. and Ph.D. Students Only

INEN-721. Systems Engineering Models **Credit 3 (3-0)**

This course presents an overview of modern quantitative and computational techniques for system modeling, design and control. Topics include fuzzy set theory, neural network, control theory, optimization search methods, Petri-nets, and knowledge-based systems. Prerequisite: Graduate Standing.

INEN-731. Engineering Cost Control **Credit 3 (3-0)**

This course is designed to emphasize the use of cost data by engineers in support of the financial management function. Cost functions, cost behavior, cash control, budgeting, and cashflow analysis are discussed.

INEN 734. Engineering Organization **Credit 3 (3-0)**

This course presents theories of organizational structures, motivation, leadership, delegation, incentives and rewards systems, teams, strategic planning, and personnel evaluation. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-735. Human-Computer Interface **Credit 3 (3-0)**

This course provides a fundamental coverage of topics in human-computer interface (HCI). The primary emphasis is on the impact of human characteristics and the use of information processing models for HCI-design, usability evaluation, virtual reality, and multimedia systems. Prerequisite: Graduate Standing.

INEN 742. Linear and Integer Programming **Credit 3 (3-0)**

This course addresses solution techniques for linear and integer programming problems.

Topics addressed include initial basic feasible solutions, large scale linear programs, column generations, scaling, Dantzig-Wolfe decomposition, Interior point methods, integer programming models, and branch and bound approaches for solving integer programming models.
Prerequisites: Graduate Standing and Consent of Instructor

INEN-745. Advanced Computer-Integrated Production Systems **Credit 3 (3-0)**

This course addresses the principles relating to integration issues for an automated manufacturing enterprise. Topics include control architectures, communication networks and standards for graphical information interchange. Current research areas will be discussed. Design projects are required. Prerequisites: INEN-624 and INEN-635.

INEN-792. Industrial Engineering Master's Seminar **Credit 1 (1-0)**

This course introduces contemporary industrial engineering topics via talks by individuals from industry, government, and academe. Prerequisites: Graduate Standing in ISE.

INEN-793. Master's Supervised Teaching **Credit 3 (3-0)**

This course provides students with the experience of assisting in instruction and evaluation of lecture and laboratory components of industrial engineering courses. Prerequisites: Graduate Standing in ISE

INEN-794. Master's Supervised Research **Credit 3 (3-0)**

This course provides students with the experience of assisting in all aspects of planning and completing research projects. Prerequisites: Graduate Standing in ISE

INEN-796. Master's Project **Credit 3 (3-0)**

This course provides the student an opportunity to complete a comprehensive industrial engineering project of their choice under the supervision of a faculty advisor. A project is an application of industrial engineering methods and techniques to a specific problem. Students are required to complete a project proposal and a final defense in accordance with departmental guidelines. Prerequisites: Graduate Standing in ISE

INEN-797. Master's Thesis Variable **Credit (1-3)**

This course provides the student an opportunity to complete a piece of original research, of their choice, in industrial engineering, under the supervision of a faculty advisor. Students are required to complete a thesis proposal and a final defense in accordance with departmental guidelines. Prerequisites: Graduate Standing in ISE

INEN-799. Continuation of Master's Project / Thesis **Credits 1 (1-0)**

This course will enable master's students who have completed all required coursework and all project/thesis credits, to complete their project/thesis work. Prerequisites: Graduate Standing in ISE

INEN-812. Advanced Ergonomics **Credit 3 (3-0)**

This course covers quantitative and qualitative analysis of human motions in space and time. Sample topics include human physiology, anthropometry, human figure modeling, and human performance for a set of task requirements and specifications. Design projects are required. Prerequisite: Graduate Standing.

INEN-813. Cognitive Systems Engineering **Credit 3 (3-0)**

This course examines the principles, theories, and applications of the cognitive basis of system design. Topics include models of human and machine information processing, mental models, human error, human-centered design, abstraction hierarchy, ecological interface, cognitive task analysis, multi-flow models, activity-behavior models, and theories of complexity in human-machine systems. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-814. Advanced Topics in Human-Machine Systems **Credit 3 (3-0)**

This course examines advanced topics in human-machine systems. Topics covered include supervisory control, human aspects of fixed and programmable automation, theories and models of complex systems, collaborative work support systems, human attention and cognitive

control of dynamic actions, and tele-operations. Applications include supervisory control in transportation, process, space operations, waste and hazardous handling, manufacturing, and other applications of automated systems. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-821. Multivariate Statistics For Engineers **Credit 3 (3-0)**

This course focuses on methods for statistical analysis of multivariate data. Topics include: dimensionality, multidimensional classification and clustering, unstructured multi-response sampling, analysis of covariance structures, such as principal components, factor analysis and canonical correlation analysis, and multivariate normal distribution and analysis of multivariate means. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-822. Advanced Systems Simulation **Credit 3 (3-0)**

This course discusses advanced statistical issues in the design of simulation experiments: variance reduction, regeneration methods, performance optimization and run sampling. Continuous simulation models are introduced. High fidelity simulation software and high-level architecture for constructing large simulation models is introduced. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-831. Service Sector Engineering **Credit 3 (3-0)**

This course focuses on the application of modeling and analysis of enterprises in the service sector of an economy. Topics include the role of the service sector in an economy, special characteristics of service operations, structuring the service enterprise, facility design for services, service quality, quantitative models for managing services. Applications in the financial services, health care, and other sectors will be emphasized. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-832. Information Technology Management **Credit 3 (3-0)**

This course focuses on productivity measurement and improvement of information technology and information system services. Other topics covered include the planning and control of human resources and budgets, as well as the planning of innovation, entrepreneurship and research and development, and the forecasting and justification of technology. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-833. Supply Chain Systems Engineering **Credit 3 (3-0)**

This course addresses the analysis and design of logistics and supply chain systems. Topics covered include: logistics and supply chain characterization, site location, mode selection, distribution planning, vehicle routing, demand management, replenishment management, geographic information systems and real-time logistics control issues. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-841. Linear and Nonlinear Optimization **Credit 3 (3-0)**

This course addresses solution techniques for linear and integer programming problems, and nonlinear optimization. Topics addressed include initial basic feasible solutions, large-scale linear programs, column generation, scaling, Dantzig-Wolfe decomposition, interior point methods, integer programming models, branch and bound approaches, unconstrained multivariate optimization, and penalty methods. Applications to engineering and economic systems are discussed. Prerequisite: Graduate Standing.

INEN-843. Queuing Theory **Credit 3 (3-0)**

This course presents stochastic models and solution techniques for such models. Specific topics include elements of queuing systems, measures of performance, arrival processes, steady state analysis, stationary arrivals, controlling service processes, priority queues, and queuing networks. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-844. Reliability and Maintenance **Credit 3 (3-0)**

This course reviews the statistical concepts and methods underlying procedures used in reliability engineering. Topics include the nature of reliability and maintenance, life failure and repair distributions, life test strategies, and complex system reliability including: series/parallel/

standby components with preventive maintenance philosophy. Analytical models are emphasized. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-851. Integrated Manufacturing Control Systems **Credit 3 (3-0)**

This course provides an advanced study of systems used for manufacturing execution and shop floor control. Traditional control and adaptive control algorithms and applications for manufacturing are explored. Integrated control system functions include scheduling, execution planning, supervisory control, human machine interface, process control, quality control, and information acquisition. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-852. Integrated Product and Process Design **Credit 3 (3-0)**

This course provides an integrated approach to the design and manufacture of a new product. Topics include product requirements, concept generation and selection, design, product optimization, tolerances, prototype development, design for manufacturability and assembly, process optimization, and quality function deployment. Prerequisite: Graduate Standing.

INEN-853. Enterprise Integration **Credit 3 (3-0)**

This course is directed toward development and contribution to the advancement of a unified framework for conceptualizing, designing, modeling, and operating advanced integrated manufacturing systems. It builds upon emerging developments in computer and communications technologies and conceptual breakthroughs regarding the nature and behavior of integrated enterprises. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-854. Inventory and Warehouse Systems **Credit 3 (3-0)**

This course investigates the integration of inventory and warehouse systems. Quantitative models for inventory and warehouse layout/location are developed and solved. Computational tools and equipment in inventory and warehouse systems are reviewed. Application of supply chain and information technology concepts to strategic inventory and warehouse system integration is addressed. Prerequisite: Graduate Standing.

INEN-885. Advanced Special Topics in Industrial Engineering **Credit 3 (3-0)**

The course will address a current body of knowledge in Industrial Engineering with a research orientation. Term papers and projects will be required. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-991. Doctoral Qualifying Examination **Credit 1 (1-0)**

This course will guide student to take the departmental Qualifying Examination. The examination will be administered towards the end of the semester. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing in ISE.

INEN 992. Doctoral Seminar in Industrial Engineering **Credit 1 (1-0)**

The course will present potential dissertation topics and research work-in-progress by faculty members and doctoral students, and talks by eminent practitioners and researchers on classical and contemporary topics in Industrial Engineering. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing in ISE.

INEN-993. Doctoral Supervised Teaching in Industrial Engineering **Credit 3 (3-0)**

This course will introduce the student to teaching courses under the guidance of a faculty member. This course will give the student experience in course planning, lecture preparation, classroom teaching, and student evaluation. Pass/Fail evaluation only; no letter grade will be given. Prerequisite: Doctoral Standing in ISE.

INEN-994. Doctoral Supervised **Credit 3 (3-0)**

This is supervised research under the direction of a member of the Graduate Faculty. This research should lead to the identification of a dissertation topic. Pass/Fail evaluation only; no letter grade will be given. Prerequisite: Doctoral Standing in ISE.

INEN-995. Doctoral Preliminary **Credit 3 (3-0)**

In this course dissertation supervisors will guide their students towards completing the

Preliminary Exam. The Preliminary Exam will consist of presenting and defending the student's dissertation proposal, and a written exam in the area of specialization. Pass/Fail evaluation only; no letter grade will be given. Prerequisites: Doctoral Standing in ISE and INEN 991.

INEN-997. Dissertation Variable

Credit (1-3)

This course provides the student an opportunity to complete a significant piece of original research, of their choice, in industrial engineering, under the supervision of a faculty advisor. Students are required to complete a dissertation proposal and a final defense in accordance with departmental guidelines. Prerequisites: Doctoral Standing in ISE and INEN 995.

INEN-999. Continuation of Dissertation Variable

Credit 1 (1-1)

This course will enable doctoral students who have completed all required coursework and all dissertation credits, to complete their dissertation research. Prerequisites: Doctoral Standing in ISE.

Leadership Studies Program

Dr. Alexander, Interim Director
aerwin@ncat.edu
Yanceyville Professional Center
(336) 275-2060 / ext. 3022

OBJECTIVE

The objectives of the Leadership Studies Graduate program are to provide theoretical and practical experiences that are essential for students pursuing a Doctor of Philosophy degree. The interdisciplinary Ph.D. emphasizes diversity, ethics, information technology, informed practice and research. In addition, the graduates of this doctoral program in Leadership Studies will realize the following interdisciplinary objectives:

1. Design, evaluate, and interpret the collection and analysis of data and their role in leadership and decision-making;
2. Critique and recommend technology to support the different components of leadership;
3. Recognize, develop and incorporate ethical judgment in leadership;
4. Recognize, value and integrate diversity for developing organizational effectiveness;
5. Understand theories of motivation and leadership as they influence ethical decision-making; and
6. Articulate a personal leadership vision that benefits the organization and the members.

Degree Offered

Leadership Studies – Doctor of Philosophy (Ph.D.)

Program Description

This is an interdisciplinary program designed for persons who desire positions of leadership in agriculture, business, industry, science, engineering, education, the military and medical fields, and who are interested and committed to conducting research in the field of Leadership Studies. The program enhances students' scholarship in the field of leadership and contributes to the accumulation of new knowledge through research and application in the study of leadership. It fosters a scholar/practitioner approach in the preparation of leaders. The mission of the program is to expand the knowledge base of concepts and theories of leadership through application of research and experiences acquired in the program.

Degree Requirements

Students seeking to earn the Doctor of Philosophy in Leadership Studies degree are required to complete a minimum of 51 hours, 42 hours of coursework and nine hours of internship/research and dissertation writing. The program consists of 24 hours of core courses, nine hours of electives, nine hours of research courses, three hours of internship, three hours of dissertation research, and a minimum of three hours of dissertation writing. The 24 hours of core courses in Leadership Studies must be taken at North Carolina A&T State University.

The program is designed for full-time and part-time students. All students must complete the program within a six-year period.

Students must obtain and maintain a grade point average (GPA – 3.0) B or better in each of the courses completed towards the Ph.D. degree.

Transfer credit will be awarded a maximum of six credit hours in research courses or any elective courses completed beyond the master's degree level. NO transfer credit will be awarded for Core Courses.

Admission Requirements

Candidates seeking admission to the Leadership Studies Program for the Doctor of Philosophy degree must meet the following requirements:

1. A master's degree from a college or university recognized by a regional or general accrediting agency.
2. A minimum of five years of work experience at the executive or managerial level or a minimum of five years in Leadership Studies research.
3. A completed Graduate Record Exam (GRE) General Test, or the Graduate Management Admissions Test (GMAT), or the Miller Analogies Test (MAT) as applicable to the discipline area of the student.
4. An applicant with his/her highest degree from a non-English-speaking country is required to complete the Test of English as a Foreign Language (TOEFL) examination and obtain a score of 600 or higher on the written examination or at least 250 on the computer examination.
5. An applicant will be interviewed by an Admissions Committee as part of the admission requirements prior to recommendation for acceptance into the program.

Note: These requirements will be reviewed periodically and revisions made as appropriate.

Documentation Requirements

The following documents are to be submitted by all applicants.

1. Two official transcripts of all college-level academic work.
2. Three letters of recommendation (for study at master's level) from professional associates or supervising faculty/professors from the degree granting institution.
3. An official copy of the GRE, GMAT, or MAT scores mailed directly to the University from the testing agency.
4. An official copy of the TOEFL score, if applicable, mailed directly to the University from the testing agency.
5. The completed application form and application fee stipulated by the School of Graduate Studies at NC A&T State University.
6. A Statement of Purpose (two pages and double-spaced) explaining the reasons for pursuing the Doctor of Philosophy degree in Leadership Studies and detailing professional work experience or leadership research background. The Statement will also be used to evaluate writing proficiency.

Candidacy

Following the successful documentation and completion of the internship as approved by the committee, the student will be admitted into candidacy for the interdisciplinary Ph.D. in Leadership Studies. The candidate will then enroll in three hours of supervised dissertation research and three hours of supervised dissertation writing and upon the successful defense of the dissertation, the candidate will be awarded the doctoral degree (Ph.D.) in Leadership Studies. Should the candidate require more than the six hours of dissertation research and writing, the candidate will enroll for additional hours provided the six-year limit has not been exceeded.

Dissertation Committee

The committee will have at least four members including the chair. At the end of eighteen hours of study, the students are required to select their four-person dissertation committee. This committee will be chaired by a faculty from the Leadership Studies Faculty. The additional committee members will consist of North Carolina A&T Faculty including eminent leaders and adjunct faculty.

The Dissertation

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must be a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the School of Graduate Studies. Three copies of the document signed by all members of the student's advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by the School of Graduate Studies to ensure that the format conforms to its specifications.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

Courses Description

LEST 800. Leadership Theories

Credit 3 (3-0)

This course explores the theoretical nature of leadership. The emphasis is on the application of theories of leadership in political, economic, social, and global contexts. A critical examination of the leadership literature and research are used to develop an appreciation for the contingency and interdisciplinary nature of leadership.

LEST 802. Decision-Making Theories and Strategies

Credit 3 (3-0)

This course focuses on the development and enhancement of strategic decision-making capabilities. It explores the theories and principles of executive decision-making processes such as qualitative decision-making models and techniques. A related emphasis is on effective communication with diverse groups, and implementation and evaluation of strategic decisions. Other topics include power and politics, managerial cognition, strategy formulation, organizational learning, organizational information processing, ethical decision-making, and the influence of technology on strategic decisions.

LEST 810. Ethics and Social Responsibility in Leadership

Credit 3 (3-0)

This course focuses on the ethical and legal dimensions of leadership, including multiple philosophies and theories. This course will provide an examination and interpretation of complex issues from the perspective of ethical leadership and diversity.

LEST 811. Human Behaviors and Relations

Credit 3 (3-0)

This course focuses on human relations theory and practice in various contexts. Emphasis is placed on the role of leaders as ethical change agents at the behavioral, interpersonal, organizational, and societal levels. Additionally, in-depth studies of human behavior theories will focus on human motivation, self-awareness, interpersonal skills and group dynamics, worldview, human relations, human interaction with technology, and personal and organizational diversity.

LEST 812. Contemporary Issues in Cultural Diversity

Credit 3 (3-0)

This course focuses on current issues in diverse cultures and the development of cultural understanding and knowledge of the literature, history, language, art, music, and social/political systems of a diverse culture.

LEST 820. Information Technology as a Leadership Tool

Credit 3 (3-0)

This course focuses on the interaction of information technology and society and how the functioning of organizations are both enhanced and constrained by information technology. Topics of study include the ethical use of technology, technology and decision making, technology as a management tool, technology as a teaming tool, technology as a leadership assessment and performance tool, and networks and the Internet.

LEST 840. Organizational Structure and Dynamics

Credit 3 (3-0)

This course examines the major theories in the study of effective organizational designs. The emphasis is on the creation and use of vertical and horizontal networks of interdependent and interrelated relationships among functional and operating units to provide the organization with adaptive capacity to respond effectively to a rapidly changing environment.

LEST 850 Leadership in the Global Economy and Society**Credit 3 (3-0)**

This course will focus on effective and ethical global leadership in the areas of decision-making, problem-solving, competencies for addressing relationships, communication, teambuilding, leading visions into actions. Additionally, the course will emphasize stress and conflict management, interdependent thinking, valuing the ability to advance the work of the institution's place in global society, communities and cultural awareness technology and global perspectives.

LEST 860 Qualitative Research**Credit(3-0)**

This course focuses on methods and tools of inquiry of qualitative research, including but not limited to developing case studies, surveys, interviews and narrative observations. Strategies for determining the intertextuality of trends and relationships as revealed in the research will be developed.

LEST 861. Computer Aided Research (prerequisite Basic Research)**Credit 3 (3-0)**

This course focuses on three areas of application of the computer in research: development and literature reviews, data collection and statistical analysis, and the presentation of findings, conclusions, and recommendations. Students will develop a synthesis of knowledge and skill in applying the computer as a tool for research.

LEST 862. Quantitative Research**Credit 3 (3-0)**

This course provides a fundamental introduction to the field of quantitative research through the development of a knowledge base and an application of research skills and methodologies required to select, read, and interpret relevant professional literature.

LEST 863. Statistical Applications and Interpretations**Credit 3 (3-0)**

This course will focus on research and case study design emphasizing implementation strategies that address organizational policies and practice. A review of paradigm shifts and an analysis of literature in the study of cultural and technological influences. In addition, the course will enhance students' understanding of how various public, private and corporate agencies are changed based on the governance and administration.

LEST 870. Internship in Leadership**Credit 3 (3-0)**

This course provides inquiry, exploration, and hands-on opportunities to observe and participate in leadership decisions. The internship will be one of professional practice internship in a leadership environment. The internship will be with a recognized business, industry, government or non-governmental leader or in an organization that emphasizes leadership. It will inform the student of current practice and lead to the dissertation research.

LEST 900. Dissertation Research**Credit 3 (3-0)**

This course focuses on the development of the dissertation proposal. The dissertation research is embedded in the internship experience that ensures a comprehensive application and utilization of research.

LEST 930. Dissertation Writing**Credit 3 (3-0)**

Dissertation writing is the culminating course in the student's doctoral program. The student will demonstrate high levels of scholarly and intellectual activity. Dissertation writing is an original contribution to knowledge in the field of study through disciplined inquiry. This course prepares a student for conducting, writing, and defending the dissertation in accordance with the highest professional standards.

LEST 999. Continuation of Doctoral Dissertation**Credit 1 (1-0)**

This course is a continuation of LEST 930. This course is for doctoral students who have completed all credit course hour requirements.

LIST OF GRADUATE COURSES**The Leadership Core – (24 Credit Hours)**

- LEST 800 - Leadership Theories *
- LEST 802 - Decision-Making Theories and Strategies *
- LEST 810 - The Role of Ethics in Leadership *
- LEST 811 - Human Behaviors and Relations *
- LEST 812 - Contemporary Issues in Cultural Diversity *
- LEST 820 - Information Technology as a Leadership Tool *
- LEST 840 - Organizational Structure and Dynamics *
- LEST 850 - Leadership in the Global Economy and Society *

Research Preparation Courses – (18 Credit Hours)

LEST 860 – Qualitative Courses **
LEST 861 – Computer Assisted Research **
LEST 862 – Quantitative Research **
LEST 863 – Statistical Applications and Interpretations**
LEST 870 – Internship in Leadership **
LEST 900 – Dissertation Research **
LEST 930 – Dissertation Writing **
LEST 999 – Continuation of Doctoral Dissertation**

Elective Discipline Courses – (9 Credit Hours)

School of Agricultural and Environmental Sciences

AGED 710 - Program Design, Management, and Evaluation***
AGED 797 - Agricultural Education Program Management Plan Project***

School of Business and Economics

BUAD 712 - Foundations of Enterprise Management***
BUAD 713 - Business Applications Development***
BUAD 715 - Quantitative Business Analysis***
BUAD 716 - Strategic Marketing***
BUAD 718 - Management and Organizational Analysis***
BUAD 730 - Human Resources Management***
BUAD 735 - Contemporary Issues in Human Resources Management***
BUAD 736 - Human Resources Management Strategy***
BUAD 746 - E-Business and E-Commerce Management***
TRAN 701 - Strategic Logistics Management***
TRAN 725 - Purchasing and Materials Management***
TRAN 727 - Global Supply Chain Management***

School of Education

ADED 773 - Leadership***
CUIN 709 - Administration and Supervision***
CUIN 711 - Research and Inquiry***
CUIN 716 - Media Center Management***
CUIN 767 - Computer Lab Supervision and Management***
MSA 771 - Diversity Issues in Administration***
MSA 772 - Administration, Management, and Supervision***
MSA 773 - Issues in Educational Administration***
MSA 774 - Curriculum and Instructional Leadership***
MSA 776 - Law, Policy, and Politics of Education***
MSA 777 - Ethical and Societal Aspects of Educational Leadership***
MSA 778 - The Principalship***

College of Engineering

AREN 753 - Building Facilities Planning and Project Management***
AREN 755 - Computer-Aided Project Management***
AREN 770 - Energy Management Planning***
INEN 721 - Systems Engineering Models***
INEN 731 - Engineering Cost Control***
INEN 735 - Human-Computer Interface***
INEN 813 - Cognitive Systems Engineering***
INEN 814 - Advanced Topics in Human-Machine Systems***
INEN 821 - Multivariate Statistics for Engineers***
INEN 822 - Advanced Systems Simulation***

INEN 831 - Service Sector Engineering***
INEN 832 - Information Technology Management***
INEN 833 - Supply Chain Systems Engineering***
INEN 831 - Service Sector Engineering***
INEN 832 - Information Technology Management***
INEN 833 - Supply Chain Systems Engineering***
INEN 853 - Enterprise Integration***

School of Technology

ECT 730 - Systems Integration for Telecommunications Managers***
GCS 733 - Graphic Communications Organization and Management***
MFG 775 - Production Management and Control***
MSIT 740 - Leadership Development Seminar***
MSIT 790 - Research Methods***
TECH 767 - Research and Literature in Technological Education***
TECH 768 - Technological Seminar***
TECH 770 - Systematic Design of Training and Development for Industry***

* = Core Courses required for all students – No Transfer
* * = Research Preparation and Dissertation Courses
*** = Elective Courses (Discipline Specialization)

Management Information Systems

Edna J. Ragins, Interim Chairperson
Room 312D Quiester Craig Hall
(336) 334-7656

OBJECTIVE

The Department of Business Administration offers a program of study leading to the Master of Science in Management degree with a major concentration in Management Information Systems (MIS). The program prepares students and professionals for careers in public and private sector positions in information systems management, human resources management, or to apply MIS concepts to other business disciplines.

DEGREE OFFERED

Master of Science in Management – Management Information Systems

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.6 (on a 4.0 scale), and a satisfactory GMAT score. Applicants who do not meet the requirements will be considered on an individual basis. A GPA of 3.0 is required for graduation.

PROGRAM REQUIREMENTS

Students with a variety of undergraduate majors are encouraged to apply. The program is designed to appeal to those who either currently work in industry or desire to affiliate with firms or organizations using cutting-edge tools to deliver their products or services. Students in the program will have a business undergraduate degree and wish to study a particular area in greater depth, or have a non-business degree with the personal or professional interests or experiences that would be enhanced by a high quality graduate program in management education.

The program requires a minimum of 36 semester hours. There is no thesis requirement. Students without an undergraduate business degree will be required to take appropriate foundation courses, which may extend the requirements to 48 semester hours. The program consists of 21 hours of core courses, including one 3-hour elective, and 15 hours of coursework in the major concentration.

The student pursuing the Master of Science in Management with a major concentration in MIS is required to complete a common core of courses consisting of:

ACCT 714 Managerial Accounting & Finance	3 semester hours
BUAD 713 Business Applications Development	3 semester hours
BUAD 715 Quantitative Business Analysis	3 semester hours
BUAD 716 Strategic Marketing	3 semester hours
BUAD 718 Management & Organization Analysis	3 semester hours
ECON 608 Managerial Economics	3 semester hours

ELECTIVE One course selected from the following:

ACCT 643 Advanced Income Tax Accounting	3 semester hours
BUAD 719 Information Systems Planning & Design	3 semester hours
Courses in the MIS concentration will consist of the following:	
BUAD 740 Management & Implementation of MIS	3 semester hours
BUAD 742 Telecommunication Systems Management	3 semester hours
BUAD 744 Enterprise Data Modeling	3 semester hours
BUAD 746 E-Business and E-Commerce	3 semester hours
BUAD 748 MIS Projects	3 semester hours

Students without an undergraduate business degree will be required to take appropriate foundation courses, which consist of the following.

ACCT 708 Seminar in Financial Concepts	3 semester hours
BUAD 705 Seminar in Business Analysis	3 semester hours
BUAD 712 Foundation of Enterprise Management	3 semester hours
ECON 706 Seminar in Economics	3 semester hours

LIST OF GRADUATE COURSES

Course Description	Credit
ACCT 643 Advanced Income Tax Accounting	3
ACCT 708 Seminar in Financial Concepts	3
ACCT 714 Managerial Accounting & Finance	3
BUAD 705 Seminar in Business Analysis	3
BUAD 712 Foundation of Enterprise Management	3
BUAD 713 Business Applications Development	3
BUAD 715 Quantitative Business Analysis	3
BUAD 716 Strategic Marketing	3
BUAD 718 Management & Organization Analysis	3
BUAD 719 Information Systems Planning & Design	3
BUAD 740 Management & Implementation of MIS	3
BUAD 742 Telecommunication Systems Management	3
BUAD 744 Enterprise Data Modeling	3
BUAD 746 E-Business and E-Commerce	3
BUAD 748 MIS Projects	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3

COURSES WITH DESCRIPTION IN BUSINESS ADMINISTRATION

BUAD-705. Seminar in Business Analysis **Credit 3 (3-0)**

This course will integrate the statistical and mathematical concepts that are essential for identifying, analyzing, and solving complex business problems. Business applications will involve investment, inventory, and capital budgeting analyses, utilizing computer spreadsheet models and the Visual Basic programming language.

BUAD-712. Foundations of Enterprise Management **Credit 3 (3-0)**

This course provides an understanding of key themes related to successful enterprise management, and discussions of the interpersonal and intellectual skills necessary to contribute to a highly competitive and globalized business environment. Topics include the globalization of commerce, marketing and market systems, competitive strategy, perspectives on legal and ethical business conduct, information technology, and the elements of quality. Individual and team competencies are developed using materials that involve interpersonal skills, problem-solving, and case analysis.

BUAD 713. Business Applications Development **Credit 3 (3-0)**

This course focuses on application development and tools for business solutions. Concepts associated with the design, creation, and implementation of computer programs are studied. Application algorithms are designed using supportive software tools such as flowcharts, pseudocode, and hierarchy charts. Emphasis is placed on the development of applications using systems methods, top-down design, testing, debugging, modularity, and structured techniques to be implemented and maintained in a variety of business environments. This course uses an object-oriented programming language.

BUAD-715. Quantitative Business Analysis **Credit 3 (3-0)**

This course familiarizes students with basic quantitative techniques for decision-making in all business functions. Specific topics will include data collection and presentation; basic descriptive statistics and probability; discrete and continuous probability distributions; confidence intervals; hypothesis testing; business forecasting; linear and multiple regression models; linear, integer, and nonlinear programming; and computer simulation. Emphasis will be on the

application of these techniques for managerial decision-making. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-716. Strategic Marketing **Credit 3 (3-0)**

This course provides in-depth examination of the role of marketing in strategic planning and decision-making. Students develop skills critical to directing business-unit marketing strategy and designing or reengineering a customer-driven organization. The course content emphasizes cases and readings. It also exposes students to emerging issues in marketing strategy including relationship marketing and e-commerce. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-718. Management and Organizational Analysis **Credit 3 (3-0)**

This course is a study of formal organizations as rational, organic, open systems and their behavior in response to an ever-changing, global and domestic environment. It covers macro and micro theories of management and organizations and their application to organizational design and processes. Organizational effectiveness, strategic planning and control, structural designs, leadership, motivation, globalization, and corporate politics and culture are studied through extensive reading, case studies, exploratory research and seminar discussions. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD 719. Information Systems Planning and Design **Credit 3 (3-0)**

This course provides students with an understanding of the concepts of planning, analysis, design, and implementation of modern information systems. Techniques used in this course are project tracking, structured analysis and design, prototyping, and techniques for incorporating human factors considerations. These project planning and design issues will be discussed both in terms of the traditional systems development life cycle and in terms of business process reengineering. Students will use both Computer Aided Software Engineering (CASE) tools, Business Process Reengineering (BPR) and Project Tracking (GANTT network diagrams, task tracking) tools in their project work.

BUAD-740. Management and Implementation of Enterprise Information Systems **Credit 3 (3-0)**

This is an applied course in concepts and techniques used in the design, development, and implementation of management information systems and decision support systems using systems design concepts and software development tools for web enabled applications. The implementation issues of organizational fit and organizational diffusion will be discussed along with security and ethics. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-742. Telecommunications Systems Management **Credit 3 (3-0)**

This course provides in-depth coverage of data communications applications and the management of telecommunications hardware and software. Emphasis is on analysis and design of networking applications, management of telecommunications networks, and evaluation of connectivity options. Topics to be covered include: telecommunications devices, media systems, network hardware and software, network configuration, network applications, cost-benefit analysis, topologies and reliability. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD-744. Enterprise Data Modeling **Credit 3 (3-0)**

From a business perspective, this course will analyze databases to facilitate surveillance and scanning for reverse competitive intelligence and for gathering data on customers and competitors. From an information perspective it will cover distributed databases, database integrity and security, data warehousing, data modeling tools, data dictionaries, and query language. Students will make extensive use of database systems. Prerequisite: BUAD 740 or BUAD 742.

BUAD-746. E-Business and E-Commerce Management **Credit 3 (3-0)**

This course is a comprehensive overview of building and managing an e-business. Topics examined include: the decision to bring a business online, choosing a business model, developing

a business plan, accepting payments, marketing strategies, and security. A complete web-based e-business storefront will be designed and developed based on a viable business model and marketing plan. Prerequisite: BUAD 740 or BUAD 742.

BUAD-748. MIS Projects

Credit 3 (3-0)

This course requires an applied project designed to provide students with the necessary skills to manage the development of technology-based solutions for opportunities faced by organizations today. Students gain practical experience in enabling change through the use of information technology. Students work in faculty-supervised teams with sponsoring businesses.

Project deliverables include: analysis and evaluation of existing business processes, evaluation of alternatives for improvement, potential for IT work process improvement, demonstration of feasibility, and an implementation plan. Prerequisite: BUAD 740, BUAD 742 and BUAD 744 or BUAD 746.

Mathematics

Wilbur L. Smith, Chairman
102 Marteena Hall
(336) 334-7822

OBJECTIVE

The School of Graduate Studies through the Department of Mathematics offers two curricula leading to the Master of Science in Education. One is intended primarily for individuals who teach mathematics at the middle school or high school level and the other is intended for individuals who teach mathematics at the high school or two-year college level. In addition, it offers a program of studies leading to the M.S. degree in Applied Mathematics.

DEGREES OFFERED

Master of Science - Mathematics, Secondary Education
Master of Science - Applied Mathematics

GENERAL ADMISSION REQUIREMENTS

Mathematics Education and Applied Mathematics students must follow the general admission requirements for graduate studies; Mathematics Education students must also satisfy the following criteria for admission to the program.

- A Bachelor's degree in Mathematics or a related field from an accredited institution.
- North Carolina "A" license in Secondary Mathematics or the equivalent from another state or eligibility to hold an "A" certification.
- An undergraduate GPA of 2.60 overall or 3.0 in the junior/senior years.
- Three (3) letters of recommendation.
- Official scores on GRE (Graduation Record Examination) or the MAT (Miller Analogies Test). Tests must be taken within the last five (5) years.

DEPARTMENTAL REQUIREMENTS

In addition to meeting general requirements specified above, a student seeking admission to a graduate program in the Department of Mathematics must have earned thirty (30) semester hours in mathematics including differential and integral calculus, linear algebra and differential equations. A student who fails to meet these requirements will be expected to enroll in appropriate undergraduate courses before beginning his graduate studies in mathematics. A student may not receive graduate credit for a course that is equivalent to one for which he received a grade of "C" or above as an undergraduate.

MATHEMATICS EDUCATION CURRICULUM

Students may select either the thesis or non-thesis option. Each option requires a total of thirty-nine (39) semester hours: fifteen (15) semester hours in Professional Education, twentyone (21) semester hours in Mathematics, and three (3) semester hours of electives. All Mathematics Education students must complete the core courses specified in the description of general requirements for a Master of Science in Education. The five (5) core Professional Education courses required are as follows:

Courses	Description
CUIN 619	Learning Theories
CUIN 711	Research and Inquiry
CUIN 721	Advanced Methods and Internship
CUIN 728	Technology Across the Curriculum
CUIN 729	Diversity

Each Mathematics Education student must complete at least one (1) course from each of

the five (5) major areas of study. Students completing the **Middle School/High School Curriculum** must take a minimum of one (1) 700 level course in Mathematics. Students completing the High-School-2 year College Curriculum must take a minimum of three (3) 700 level courses in Mathematics.

The five major areas of study include:

1. Algebra:

- MATH 602 Modern Algebra
- MATH 612 Advanced Linear Algebra
- MATH 665 Principles of Optimization
- MATH 712 Numerical Linear Algebra
- MATH 717 Special Topics in Algebra

2. Analysis:

- MATH 603 Introduction to Real Analysis
- MATH 610 Complex Variables I
- MATH 611 Complex Variables II
- MATH 620 Elements of Set Theory and Topology
- MATH 650 Ordinary Differential Equations
- MATH 651 Partial Differential Equations
- MATH 700 Theory of Functions of a Complex Variable I
- MATH 711 Theory of Functions of a Complex Variable II
- MATH 720 Special Topics in Analysis
- MATH 751 Solution Methods in Integral Equations
- MATH 752 Calculus of Variations and Control Theory

3. Geometry:

- MATH 604 Modern Geometry for Secondary School Teachers
- MATH 715 Projective Geometry

4. Statistics:

- MATH 608 Methods of Applied Statistics
- MATH 623 Probability Theory and Applications
- MATH 624 Theory and Methods of Statistics
- MATH 706 Categorical Data Analysis
- MATH 708 Nonparametric Statistics
- MATH 721 Multivariate Statistical Analysis
- MATH 731 Advanced Numerical Methods

5. Applications of Technology in Mathematics:

- MATH 601 Technology and Applications in Secondary School Mathematics
- MATH 608 Methods of Applied Statistics
- MATH 624 Theory and Methods of Statistics
- MATH 631 Linear and Non-Linear Programming
- MATH 665 Principles of Optimization
- MATH 706 Categorical Data Analysis
- MATH 708 Nonparametric Statistics
- MATH 712 Numerical Linear Algebra
- MATH 721 Multivariate Statistical Analysis
- MATH 731 Advanced Numerical Methods
- MATH 765 Optimization Theory and Applications

Other Requirements:

1. Thesis or Research Project or Portfolio
2. Comprehensive Examination in Mathematics
3. Comprehensive Examination in Education

APPLIED MATHEMATICS CURRICULUM

A student seeking the Master of Science in Applied Mathematics must complete the following:

1. At least fifteen semester hours of 700-level courses in either mathematics or an applications area of mathematics.
2. A minimum of eighteen semester hours of credit in the Department of Mathematics.
3. A thesis or a project.

4. A minimum of thirty semester hours of graduate credit.

Courses

MATH 600	Introduction to Modern Mathematics for Secondary School Teachers
MATH 601	Technology and Applications in Secondary School Mathematics
MATH 602	Modern Algebra
MATH 603	Introduction to Real Analysis
MATH 604	Modern Geometry for Secondary School Teachers
MATH 606	Mathematics for Chemists
MATH 607	Theory of Numbers
MATH 608	Methods of Applied Statistics
MATH 610	Complex Variables I
MATH 611	Complex Variables II
MATH 612	Advanced Linear Algebra
MATH 620	Elements of Set Theory and Topology
MATH 623	Probability Theory and Applications
MATH 624	Theory and Methods of Statistics
MATH 625	Mathematics for Elementary School Teachers I
MATH 626	Mathematics for Elementary School Teachers II
MATH 631	Linear and Non-Linear Programming
MATH 632	Games and Queuing Theory
MATH 633	Stochastic Processes
MATH 650	Ordinary Differential Equations
MATH 651	Partial Differential Equations
MATH 652	Methods of Applied Mathematics
MATH 665	Principles of Optimization
MATH 675	Graph Theory
MATH 691	Special Topics in Applied Mathematics
MATH 700	Theory of Functions of a Real Variable I
MATH 701	Theory of Functions of a Real Variable II
MATH 705	Graduate Seminar
MATH 706	Categorical Data Analysis
MATH 708	Nonparametric Statistics
MATH 710	Theory of Functions of a Complex Variable I
MATH 711	Theory of Functions of a Complex Variable II
MATH 712	Numerical Linear Algebra
MATH 715	Projective Geometry
MATH 717	Special Topics in Algebra
MATH 720	Special Topics in Analysis
MATH 721	Multivariate Statistical Analysis
MATH 723	Advanced Topics in Applied Mathematics
MATH 725	Graduate Design Project
MATH 730	Thesis Research in Mathematics
MATH 731	Advanced Numerical Methods
MATH 751	Solution Methods in Integral Equations
MATH 752	Calculus of Variations and Control Theory
MATH 765	Optimization Theory and Applications
MATH 733	Advanced Probability and Stochastic Processes
MATH 781	Mathematical and Computational Modeling
MATH 782	Scientific Visualization
MATH 791	Interdisciplinary Computational Science Team Project I
MATH 792	Interdisciplinary Computational Science Team Project II

COURSES WITH DESCRIPTION IN MATHEMATICS

Advanced Undergraduate and Graduate

MATH-600. Introduction to Modern Mathematics for Secondary School Teachers **Credit 3 (3-0)**

Elementary theory of sets, elementary logic and propositional systems, nature and methods of mathematical proofs, structure of the real number system. Open only to in-service teachers or to others having the permission of the Department of Mathematics.

MATH-601. Technology and Applications in Secondary School Mathematics **Credit 3 (3-0)**

This course covers techniques of teaching algebra, advanced algebra, trigonometry, and other secondary mathematics using graphing calculators, software packages and other technology. Prerequisite: Consent of the instructor.

MATH-602. Modern Algebra **Credit 3 (3-0)**

This course covers mappings, binary operations, groups, rings, integral domains, fields, and some applications to coding and cryptography. Prerequisite: MATH 311 or consent of the instructor.

MATH-603. Introduction to Real Analysis **Credit 3 (3-0)**

The following topics will be covered in this course: elementary set theory, functions, axiomatic development of the real number system, metric spaces, convergent sequences, completeness, compactness, connectedness, continuity, limits, sequences of functions, differentiation, the mean value theorem, Taylor's theorem, Riemann integration, infinite series, the fixed point theorem, partial differentiation, and the implicit function theorem. Prerequisite: MATH-311 or consent of the instructor.

MATH-604. Modern Geometry for Secondary School Teachers **Credit 3 (3-0)**

Re-examination of Euclidean geometry, axiomatic systems and the Hilbert axioms, introduction to projective geometry and other non-Euclidean geometries. Prerequisite: MATH-600 or consent of the Department of Mathematics.

MATH-606. Mathematics for Chemists **Credit 3 (3-0)**

Review of those principles of mathematics involved in chemical computations and derivations from general chemistry through physical chemistry; topics covered include significant figures, methods of expressing large and small numbers, algebraic operations, trigonometric functions and an introduction to calculus.

MATH-607. Theory of Numbers **Credit 3 (3-0)**

Divisibility properties of the integers, the Euclidean algorithm, congruences, diophantine equations, number-theoretic functions and continued fractions. Prerequisite: Twenty hours of college mathematics.

MATH-608. Methods of Applied Statistics **Credit 3 (3-0)**

This course introduces the SAS programming language and uses it in the analysis of variance, both single and multi-factor. It includes various methods of hypothesis testing and constructing confidence intervals. The course covers simple and multiple linear regression, including model building and variable selection techniques. Elements of time series and categorical data analysis are covered. Prerequisite: MATH-224.

MATH-610. Complex Variables I **Credit 3 (3-0)**

The following topics will be covered in this course: complex number system, limits of complex sequences, complex functions, continuity, limits of functions, derivatives, elementary functions, Cauchy-Riemann equations, antiderivatives harmonic functions, inverse functions, power series, analytic functions, analytic continuation, contour integrals, Cauchy's theorem and Cauchy's integral formula. Prerequisite: MATH-231.

MATH-611. Complex Variables II **Credit 3 (3-0)**

MATH-611 is a continuation of MATH-610. The following topics will be covered in this course: Liouville's theorem, the fundamental theorem of algebra, the winding number, generalized Cauchy theorems, singularities, residue calculus, Laurent series, boundary value problems, harmonic functions, conformal mappings, Poisson's formula, potential theory, physical applications and the Riemann mapping theorem. Prerequisite: MATH-610.

MATH-612. Advanced Linear Algebra **Credit 3 (3-0)**

This course covers vector spaces, linear transformations and matrices determinants and systems of linear equations, eigenvalues and eigenvectors, diagonalization, inner products, bilinear quadratic forms, canonical forms, and application to engineering and applied sciences. Prerequisite: MATH-450 or consent of the instructor.

MATH-620. Elements of Set Theory and Topology **Credit 3 (3-0)**

Operations on sets, indexed families of sets, products of sets, relations, functions, metric spaces, general topological spaces, continuity, compactness and connectedness. Prerequisites: MATH-231 and consent of the instructor.

MATH-623. Probability Theory and Applications **Credit 3 (3-0)**

This course begins with an introduction to sample spaces and probability, including combinatorics. It covers continuous and discrete random variables, including multivariate, random variables and expectations; also marginal and conditional distributions are derived. The course introduces moment generating functions, and covers the central limit theorem and its applications. Prerequisite: MATH-231.

MATH-624. Theory and Methods of Statistics **Credit 3 (3-0)**

This course introduces methods of statistical estimation and inference including the following topics: sufficient statistics, confidence sets, hypothesis tests, and maximum likelihood methods. The theory of uniformly most powerful tests and the Neyman-Pearson Lemma are covered. Other topics include least squares estimation, the linear model, and Bayesian methods. Prerequisite: MATH-623.

MATH-625. Mathematics for Elementary Teachers, K-8, I **Credit 3 (3-0)**

Designed for in-service and prospective teachers who have as their goal "to teach the basic skills and competencies of mathematics sought in today's world." The course emphasizes that the teacher, first, must have the knowledge and skills in order to accomplish this goal. It stresses fundamentals of arithmetic, sets and operations, number systems, fractions, decimals, percents, estimation, consumer arithmetic, problem solving and traditional and metric geometry and measurement. This course may not be used for degree credit.

MATH-626. Mathematics for Elementary Teachers, K-8, II **Credit 3 (3-0)**
(Formerly 3686)

A continuation of MATH-625. No credit towards a degree in mathematics; not open to secondary school teachers of mathematics. Credit on elementary education degree. Prerequisite: MATH-625.

MATH-631. Linear and Non-Linear Programming **Credit 3 (3-0)**

This course covers optimization subject to linear constraints, transportation problems, simplex method, network flows, applications of linear programming to industrial problems and economic theory, and an introduction to non-linear programming. Prerequisites: MATH-450 and consent of the instructor.

MATH-632. Games and Queue Theory **Credit 3 (3-0)**

General introduction to game theory; two-person-non-zero-sum-non-cooperative games; twoperson cooperative games; reasonable outcomes and values; the minimax theorem. Introduction to queuing theory; single server queuing processes; many serve queuing processes; applications to economics and business. Prerequisites: MATH-224, MATH-450 or consent of the instructor.

MATH-633. Stochastic Processes**Credit 3 (3-0)**

This course begins with a review of Probability and Random Variables. Markov Processes, Poisson Processes, Waiting Times, Renewal Phenomena, Branching Processes, Queuing System, Service Times are covered. Prerequisite: MATH-623 or consent of the instructor.

MATH-650. Ordinary Differential Equations**Credit 3 (3-0)**

This is an intermediate course in ordinary differential equations with emphasis on applications. Topics include linear systems and various phase plane techniques for non-linear ordinary differential equations. Prerequisite: MATH-431.

MATH-651. Partial Differential Equations**Credit 3 (3-0)**

This course includes introduction to complex variables and residue calculus, transform calculus, higher order partial differential equations governing various physical phenomena, nonhomogeneous boundary value problems, orthogonal expressions, Green's functions and variational principles. Prerequisites: MATH-431, 432.

MATH-652. Methods of Applied Mathematics**Credit 3 (3-0)**

This course covers matrix theory, systems of linear equations, vector spaces, eigenvalue problem and its applications to systems of linear ODEs and mechanical vibrations, the simplest problems of calculus of variations, Euler equations, boundary conditions, extensions of Euler equations, Hamilton's Principles, constraints and Lagrange multipliers, introduction to integral equations, and solutions in iterative and other methods. Prerequisites: MATH 431, 432.

MATH-665. Principles of Optimization**Credit 3 (3-0)**

Algebra, linear inequalities, duality, graphs, transport networks; linear programming; special algorithms; selected applications. An upper level course. Prerequisites: MATH-231 or equivalent and MATH-450.

MATH-675. Graph Theory**Credit 3 (3-0)**

Varieties of graphs, graph theory algorithms, and applications of graph theory to other disciplines. Prerequisite: MATH-450.

MATH-691. Special Topics in Applied Mathematics**Credit 3 (3-0)**

Topics are selected from differential equations, numerical methods, operations research, applied mechanics and from other fields of applied mathematics. Prerequisites: Senior or graduate standing and consent of the instructor.
Graduate Students Only

MATH-700. Theory of Functions of a Real Variable I**Credit 3 (3-0)**

The focus of this course is a careful study of the fundamental theorems of Lebesgue theory, including Lebesgue measure, differentiation and integration on the real line. Topics from set theory and point set topology are also included in this course. Prerequisite: MATH-507 or equivalent.

MATH-701. Theory of Functions of a Real Variable II**Credit 3 (3-0)**

This course is a continuation of MATH-700. The following topics will be covered in this course: general measure and integration, measure and outer measure, and some basic topics from functional analysis. Prerequisite: MATH-700.

MATH-705. Graduate**Seminar 1(0-2)**

The seminars will present current developments and ideas in applied mathematics and computational science. Topics explored may consist of material from various mathematics and computational science journals, including discussion of research by faculty and students. This course may be repeated for up to 3 credits hours. Prerequisite: Graduate Standing.

MATH-706. Categorical Data Analysis**Credit 3 (3-0)**

This course will include the following topics: Two-Way Contingency Table Inference for Two-Way Table, Models for Binary Response Variables, Log-linear Models, Testing in Loglinear Models, Multinomial Response Models and Estimation Theory for Parametric Models, and

Computer Analysis of Categorical Data. Prerequisite: MATH 624.

MATH-708. Nonparametric Statistics **Credit 3 (3-0)**

The following topics will be discussed in this course: Order Statistics, Run Test for Trend, Goodness of Fit Tests, Rank Tests for One and Two Populations, Linear Rank Statistics, One-Way and Two -Way Nonparametric Analysis of Variance, and applications to practical problems. Prerequisite: MATH 624.

MATH-710. Theory of Functions of a Complex Variable I **Credit 3 (3-0)**

This course includes basic theory of analytic functions, including Cauchy's theorem, conformal mappings, Taylor and Laurent series, and residue theory. Prerequisite: MATH-507 or equivalent.

MATH-711. Theory of Functions of a Complex Variable II **Credit 3 (3-0)**

This course is a continuation of MATH-710. Basic theory and applications of conformal mappings, fractional linear, analytic continuation, and Riemann surfaces will be covered in this course. Prerequisite: MATH-710.

MATH-712. Numerical Linear Algebra **Credit 3 (3-0)**

Numerical analysis for solution of linear systems, approximation methods foreign values and eigenvectors, least squares solutions, ill-posed and ill-conditioned systems and error analysis are covered. Prerequisite: One programming language, MATH-450 or equivalent.

MATH-715. Projective Geometry **Credit 3 (3-0)**

A study of non-Euclidean geometry dealing with ordinary points, ideal points, ordinary lines, ideal lines, ordinary planes and ideal planes. The course deals with perceptivities and projectivities, harmonic sets of points and lines, dualities and related items in a non-metric setting. Prerequisites: Graduate standing and consent of the instructor.

MATH-717. Special Topics in Algebra **Credit 3 (3-0)**

This course covers selected topics in algebra. Topics covered will be determined by the instructor. Prerequisites: Consent of the instructor and graduate standing.

MATH-720. Special Topics in Analysis **Credit 3 (3-0)**

This course covers selected topics in analysis. Topics covered will be determined by the instructor. Prerequisites: Consent of the instructor and graduate standing.

MATH-721. Multivariate Statistical Analysis **Credit 3 (3-0)**

Multivariate Normal Distribution, Inference About a Mean Vector, Comparison of Several Multivariate Means, Analysis of Covariance Structure, Analysis of Dispersion, Classification and Clustering Techniques and Some Applications of Multivariate Tests will be discussed in this course. Also, practical examples of industrial use will be addressed. Prerequisites: MATH 608 and MATH 624.

MATH-723. Advanced Topics in Applied Mathematics **Credit 3 (3-0)**

This course is designed to cover important topics in applied mathematics that may be desired from time to time for specific students in the graduate program. It may also be used as a vehicle for development of new courses for graduate program students. Prerequisite: Consent of the instructor.

MATH-725. Graduate Design Project **Credit 3 (3-0)**

This course requires independent project work on an advanced mathematical topic of interest to the student and a faculty member acting as the student's advisor. The topic must be approved by the advisor. Prerequisite: Consent of the instructor.

MATH-730. Thesis Research in Mathematics **Credit 3 (3-0)**

Students who select the thesis option must do advanced research in an area of interest. The research topic must be approved by the thesis advisor.

MATH-731. Advanced Numerical Methods**Credit 3 (3-0)**

This course covers numerical methods for solution of parabolic, elliptic and hyperbolic boundary value problems. Problems are selected from engineering applications. Both finite difference and finite element methods are studied. Prerequisite: MATH-460 or equivalent.

MATH-733. Advanced Probability and Stochastic Processes**Credit 3 (3-0)**

The following topics will be discussed in this course: introduction to Lebesgue integration, probability theory and random variables, laws of large numbers, central limit theorems, random walks, martingales, Markov processes and Markov chains, ergodic theorems and Brownian motion. Prerequisite: MATH 603 or permission of the instructor.

MATH-751. Solution Methods in Integral Equations**Credit 3 (3-0)**

This course includes an introduction to integral equations, including Volterra equations, Fredholm equations, symmetric kernels, orthogonal systems of functions, and types of singular and non-linear integral equations. Applications to engineering areas are also discussed. Prerequisites: MATH-431, MATH-432 or equivalent.

MATH-752. Calculus of Variation and Control Theory**Credit 3 (3-0)**

This course covers the following topics: Functionals, Euler's equation, Lagrange multipliers, Kuhn-Tucker conditions, Pontryagin maximum principle, Weierstrass-Erdmann corner conditions, Euler-Lagrange equations; first and second variational problems. Applications to engineering areas will also be included. Prerequisites: MATH-431, MATH-432 or equivalent.

MATH-765. Optimization Theory and Applications**Credit 3 (3-0)**

Gradient methods for unconstrained optimization, constrained nonlinear optimization, optimization of multi-steps, variational principles, and applications relating to business and engineering are discussed. Prerequisites: MATH-450, MATH-431, MATH-432.

MATH-781. Mathematical and Computational Modeling**Credit 3(2-2)**

This course explores the steps required to model and simulate a system, including discussion of generic governing equations, grid generation, basic numerical schemes, simulation strategies, and data analysis. Both discrete and continuous methods used in scientific applications will be examined. Representative applications include weather prediction, molecular dynamics, scheduling problems, and engine combustion modeling. Prerequisite: MATH 480.

MATH-782. Scientific Visualization**Credit 3(2-2)**

This course explores concepts and techniques for visualization and its implementation, with emphasis on the use of visualization tools in mathematical simulation modeling. The course will provide practical experience with visualization packages in both X-Windows and mainframe environments. Prerequisite: MATH 781.

MATH-791. Interdisciplinary Computational Science Team Project I**Credit 3(1-4)**

This course continues development of skills required for independent research of problem-solving in the realm of computational science. The course requires completion of a sound literature review on a topic in computational science, under the guidance of the instructor. Prerequisite: MATH 480.

MATH-792. Interdisciplinary Computational Science Team Project II**Credit 3(1-4)**

This course continues development of skills required for independent research or problem-solving in the realm of computational science. The course requires completion of an agreed upon computational project, based upon a sound literature review, under the guidance of the instructor. Prerequisite: MATH 791.

Manufacturing Systems

<http://www.ncat.edu/~sot/mfg/>

Dr. Derrek B. Dunn, Interim Chairperson

PROGRAM DESCRIPTION

The School of Technology at North Carolina A&T State University offers a Master of Science in Industrial Technology (MSIT) degree. This program is coordinated by the Department of Manufacturing Systems and is designed to increase students' understanding of industrial management challenges in an array of technical areas and to explore effective methods for dealing with accelerated technological change.

DEGREES OFFERED

Manufacturing Systems – Master of Science in Industrial Technology

ADMISSION REQUIREMENTS

The Master of Science in Industrial Technology, within the School of Technology, requires the GRE General Test as part of the admission process. No minimum score is required at this time. Please contact the Graduate School Office for more information.

PROGRAM OBJECTIVES

The MSIT degree program is built upon the competencies achieved at the baccalaureate level in the industrial technology curriculum and thus enable students to secure applications oriented “technical-management” positions in today’s industrial environment. Specifically, the MSIT program is designed to prepare technical-management professionals and enhance their proficiencies in the following areas:

1. Planning, organization and management of technology, people, and resources;
2. Applying and controlling the use of various high technologies, e.g., computer-aided drafting and design (CADD), computer integrated manufacturing (CIM), machine vision and photonics, telecommunications and wireless communications, computerized construction estimating systems, safety support systems, etc.
3. Control processes to improve quality, reliability and productivity
4. Human resource management and the development of a changing work place to achieve organizational goals; and
5. Problem-solving and creative thinking skills.

TARGET AUDIENCE AND CAREER OPPORTUNITIES

This program is designed to serve the diverse needs of persons who are interested in pursuing careers in technology. Included in this group are the following: (1) persons currently employed in industrial management positions and have professional growth aspirations; (2) individuals recently completing their undergraduate study and want additional preparation prior to embarking on a career in industry; and (3) students interested in entering an advanced graduate degree program (Ph.D., Ed.D., etc.) and whose ultimate goal is university teaching and/or research. Graduates of the program should be able to perform more creatively and competently in leadership roles involving planning, problem solving, and decision-making. Additionally, the program is designed to enhance student competencies in the areas of research and scholarly writing.

INDUSTRIAL TECHNOLOGY

A total of 36 hours is required for the Master of Science in Industrial Technology with a concentration in Manufacturing Systems. The total consists of 12 SH of Core Courses, 6 SH of Management Electives, 9 SH of Technical Electives and 9 SH of Required Courses.

PROGRAM CURRICULA

Core Courses (12 credit hours)	Credits
MSIT 610 Problem Solving in Industrial Technology	3
MSIT 700 Concepts of Technological Innovations	3

MSIT 740 Leadership Development Seminar	3
MSIT 779 Statistical Research in Industrial Technology	3
Management Course- (6 credit hours)	
MSIT 673 Industrial Productivity Measurement & Analysis	3
MFG 735 Manufacturing Organization and Management	3
MFG 745 Managing Project Development	3
MFG 755 Production Management and Control	3
MFG 770 Managing a Total Quality System	3
MFG 772 Strategic Concepts in Quality	3
-Technical Electives- (9 credit hours)	
MFG 651 Principles of Robotics	3
MFG 674 Advanced Automation and Control	3
MFG 682 Non-Destructive Evaluation (NDE) Technology II	3
MFG 690 Special Problems in Manufacturing Systems	3
MFG 696 Applied Computer Integrated Manufacturing	3
MFG 699 Independent Study in Manufacturing Technology	3
MFG 710 Manufacturing Materials	3
MFG 715 Tool Technology	3
MFG 760 Advanced Manufacturing Process/CNC	3
MFG 780 Reliability Testing and Analysis	3
MFG 799 Special Topics in Manufacturing Technology	3
-Required Courses- (9 credit hours)	
<i>Select either Non Thesis or Thesis Option</i>	
<u>Non-Thesis Option:</u>	
MSIT 750 Internship I	3
MSIT 751 Internship II	3
MSIT 789 Master's Project	3
or	
<u>Thesis Option:</u>	
MSIT 780 Statistical and Research Methods in Industrial Technology II	3
MSIT 791 Research for Master's Thesis I	3
MSIT 792 Research for Master's Thesis II	3
-Required Examination- (0 credit hours)	
MFG 788 Master's Comprehensive Examination	0

COURSES DESCRIPTION IN MANUFACTURING SYSTEMS (MFG, MSIT) **Undergraduate/Graduate**

- MSIT-610. Problem Solving in Industrial Technology** **Credit 3 (3-0)**
This course teaches the fundamentals of problem solving as they are applied to an industrial technology environment. Included are analytical as well as creative problem solving techniques. Industrial projects within assigned teams are required.
- MFG-651. Principles of Robotics** **Credit 3 (1-3)**
This course emphasizes the study of robotics principles and logic control manipulators towards the total integration into a flexible manufacturing system.
- MSIT-673. Industrial Productivity Measurement and Analysis** **Credit 3 (3-0)**
Study of work measurement and method analysis towards establishing work standards and measuring productivity in industries.

MFG-674. Study of Automation and Control Systems**Credit 3 (1-3)**

This course emphasizes the study of automation and control system to include application of PLC, CAD, CAM, CNC, sensors and robotics to simulate a total computer-integrated manufacturing (CIM) environment.

MFG -682. Non-Destructive Evaluation (NDE) Technology II**Credit 3 (2-2)**

This course presents the newly developed and/or advanced NDE technologies, such as acoustic emission techniques, magnetic flux leakage techniques, radiographic techniques, thermal infrared testing, microwave techniques, ultrasonic holography, and vibro-thermographic techniques. For each of these technologies, a series of topics will be discussed: physical principles, testing procedures, application areas, equipment, instruments, data acquisition, data analysis, flaw indication, advantages and limitations.

MFG-690. Special Problems in Manufacturing Technology**Credit 3 (3-0)**

This course is to provide a forum for dialogue about areas of interest to students pertaining to issues and or skill development. This will be accomplished through the definition, exploration, and tentative resolution of selected current and evolving industrial technology. This experience is targeted toward providing students the opportunity to think about a particular concern and/or interest then to develop a final product in the form of paper and presentation.

MFG-696. Applied Computer Integrated Manufacturing (CIM)**Credit 3 (2-2)**

This course is designed to provide a working knowledge of computer integrated manufacturing (CIM). It will provide hands-on experience using sensing devices necessary to control a CIM system. Prerequisite: MFG-674.

MFG-699. Independent Study in Manufacturing Technology**Credit 3 (3-0)**

The student selects a problem, either management or technical in nature, in consultation with a faculty member in this area of interest. This problem may be research or application oriented in nature. A standard report format will be required. Prerequisite: Consent of the instructor.

MFG-700. Concepts of Technological Innovations**Credit 3 (3-0)**

This course will provide instruction in the concepts of technological innovations. Contemporary issues are also explored.

MFG-710. Manufacturing Materials**Credit 3 (3-0)**

This course surveys the materials commonly used to manufacture products. It explores the way these materials are formed. Covered are traditional metals and plastics as well as emerging high tech materials. The practical applications of these materials are emphasized. Prerequisite: MFG-471 or equivalent or consent of instructor.

MFG-715. Tool Technology**Credit 3 (2-1)**

Includes coverage of tool layout, tool material, tool wear and failure, work holding principles, jig and die, specifications for press working, blanking, bending, forming, drawing, and forging, etc. Tooling for joining processes such as welding, soldering, brazing, mechanical joining, and adhesive bonding are covered, as well as the use of computers in tooling. Prerequisite: MFG-472 or equivalent or consent of instructor.

MFG-735. Manufacturing Organization and Management**Credit 3 (3-0)**

This course surveys contemporary manufacturing organization and management issues, focusing on manufacturing aspects of the product cycle, research and development, product design, marketing, sales and distribution. This course explores new trends in technology management and quality of work life issues.

MSIT-740. Leadership Development Seminar**Credit 3 (3-0)**

This is an experiential seminar designed for assessment of the individual's managerial strengths and weaknesses in a manufacturing management position. Current and evolving leadership issues will be discussed and leadership models will be presented. Managerial and leadership issues in high participation work places will be stressed. Students will participate in behavioral simulations and receive psychometric feedback.

MFG-745. Managing New Product Development**Credit 3 (3-0)**

This course covers the product development cycle and emphasizes the benefits of Early Manufacturing Involvement (EMI) and Logistics Processes. Use of cross-functional teams in product development is also explored.

MSIT-750. Internship I**Credit 3 (0-6)**

This course is designed to provide students with an internship experience in an industrial environment related to their technical discipline. Students must be employed full-time for one semester. Evaluation will be based on reports from the student's industrial supervisor and the university coordinator. Prerequisite: 15 hours graduate credit.

MSIT-751. Internship II**Credit 3 (0-6)**

This course is designed to provide students with an additional semester of internship experience related to their technical discipline.

MFG-755. Production Management and Control**Credit 3 (3-0)**

This course focus is on production scheduling, work flow, and inventory flow, Just-in-time (JIT), and Material Resources Planning (MRP) are explored as techniques for structuring production as well as inventory management. Traditional work design is compared to newer, more high participative work designs including self-managed teams.

MFG-760. Advanced Manufacturing Process/Computer Numerical Control (CNC)**Credit 3 (1-2)**

This course explores applications in advanced Computer Numerically Controlled (CNC) machine tool technology with precision work performed on lathes, mill, Electrostatic Discharge Machining (EDM), and surface drilling work stations. Prerequisite: MFG-472 or consent of instructor

MFG-770. Managing a Total Quality System**Credit 3 (3-0)**

The study of total quality control systems assists to reduce defects, lower costs, and increase productivity in a manufacturing environment. Study includes implementing quality through Statistical Process Control (SPC), managing quality, quality information systems, quality circles, and quality work-life concepts. Prerequisite: MFG-495 or equivalent or consent of instructor

MFG 772. Strategic Concepts in Quality**Credit 3 (3-0)**

This course has four parts. Part I, Introduction to Total Quality, presents the core principles of TQ and begins to explain how they relate to management concepts. This section also explains many of the most common quality techniques students are likely to encounter. Part II, Total Quality and Organization Theory, introduces the idea of customer-supplier relations and shows how TQ relates to topics including organization-environment relations, organizational design, and change. Part III, Total Quality and Organizational Behavior will discuss the themes of teamwork and empowerment and relates TQ on both the content and process of competitive strategy. The bibliography at the end of the textbook provides a number of references for the selection of the Quality Paper and Quality Presentation requirement of this course.

MSIT 779. Statistical Research in Industrial Technology**Credit 3 (3-0)**

This course introduces the concepts and methods of statistics, which include descriptive statistics, probability theory, sampling distribution, interval estimation, hypothesis testing, statistical inferences, linear and multiple regressions, auto- and cross-correlation, and non-parametric statistical methods. The course also emphasizes the applications of the statistics to the research and development in industrial technologies, which include research design, data collection and analysis, proposal development and reports

MFG-780. Reliability Testing and Analysis**Credit 3 (3-0)**

Study of Metrology and reliability testing at various stages of manufacturing processes for zero failures. Includes destructive and non-destructive testing procedures, failure analysis, exponential and Weibull Failure Law, and reliability prediction of components and/or systems.

MFG 788. Master's Comprehensive Exam**Credit 0(0-1)**

This course will aid in the preparation of the graduate student to take the Master of Science in Industrial Technology (MSIT) comprehensive examination. The examination will be administered towards the end of the semester or summer session. This course will be graded on a Pass/Fail basis. The passing of this course is a requirement for graduation from the MSIT program. Prerequisites: 24 credit hours of graduate level courses. (F;S;SS)

MSIT-789. Master's Degree Project**Credit 3 (3-0)**

The master's degree project is designed to be a culminating experience for the master's degree. It is applications oriented and focuses on an actual project related to the student's technical discipline. The course is intended to integrate the learning from the classes taken in the degree program. Prerequisite: 24 hours graduate credit.

MSIT-790. Research Methods

Credit 3 (3-0)

This course explores empirical methodologies that are applicable to technical research investigation. Prerequisites: Graduate standing and consent of thesis advisor.

MSIT-791. Thesis I

Credit 3 (3-0)

The student will select a research topic that is of special interest and approved by his/her graduate thesis advisor. Prerequisite: MSIT 790 or consent of advisor.

MSIT-792. Thesis II

Credit 3 (3-0)

The student may enroll in this course to complete approved research for the thesis. Prerequisites: MSIT 790, MSIT 791 or consent of advisor.

MFG-799. Special Topics in Manufacturing Technology

Credit 3 (3-0)

This course will allow a group of students to work on special topics of interest which are not covered by an existing course. These are emerging themes that reflect the rapidly changing nature of “World Class Manufacturing” environments. Prerequisite: Consent of the instructor.

Mechanical and Chemical Engineering

Leonard Uitenham, Department Chairperson
Chemical Engineering - Master of Science
Mechanical Engineering - Master of Science
Mechanical Engineering – Doctor of Philosophy
<http://www.ncat.edu/~meen/>

GENERAL PROGRAM REQUIREMENTS

Each program in the Department is individually accredited and program requirements are defined by the individual programs.

OBJECTIVE

The objective of the graduate program in Chemical Engineering is to provide advanced level study in chemical engineering. The program will serve as preparation for further advanced study at the doctoral level or for advanced chemical engineering practice in industry.

DEGREE OFFERED

Master of Science in Chemical Engineering (MSChE)

GENERAL AND DEPARTMENTAL ADMISSION REQUIREMENTS

All applicants to MSChE program must have earned a bachelor's degree from a four-year college. Students that meet this requirement may be admitted to the graduate school.

Applicants are admitted without discrimination of race, color, creed, sex, religion or national origin. Applicants may be admitted to graduate studies unconditionally, provisionally, or as special students. Unconditional admission to the Master of Science in Chemical Engineering will be granted to graduates of ABET accredited chemical engineering programs that have attained a minimum of a 3.0 Grade Point Average on their overall undergraduate program of study. Provisional admission may be granted to persons with other qualifications. Applicants for provisional admission will be evaluated on a case-by-case basis.

A student admitted provisionally is required to meet with the CHEN Director to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate transcript. All provisionally admitted students must earn a minimum of a 3.0 grade point average on the first nine graduate course credits they complete. In addition, a "B" grade point average must be earned on all non-credit undergraduate courses, if any, required as a condition of admission. In addition to these provisions, other conditions may be imposed on a case-by-case basis as approved by the Graduate School.

The Master of Science in Chemical Engineering program consists of three distinct options: a thesis option, a project option and a course work option. Requirements for each of the options are given below:

Option	Semester Hours Required
Thesis	24 Credits of Courses and 6 Credits of Thesis
Project	30 Credits of Courses and 3 Credits of MS Project
Course Work	33 Credits of Courses

All students pursuing any of the MSChE options must complete four (4) courses from the MSChE core courses. In addition, students must enroll in the MSChE seminar each semester. Seminar credits do not count toward graduation requirements. The four (4) core courses must be selected from the following list:

Number	Course	Credit
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)

CHEN 630	Transport Phenomena I	3 (3-0)
CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)

Thesis Option: All students enrolled in this program must take six (6) credit hours of thesis and twenty-four (24) credit hours of courses. Of the twenty-four (24) credit hours of courses, at least nine credit hours of courses must be at the 700 level and at least four courses (12 credit hours) from the MSChE core courses list. With the approval of the thesis advisor, a student may take nine (9) credit hours of graduate courses from outside the CHEN Department in the areas of Mathematics, Science and Engineering. Thesis option students must pass an oral, public defense of their work. The defense is evaluated by a committee of at least three faculty who are appointed by the thesis advisor and the CHEN Director. The defense committee serves as a professional review of the quality of the student's work and, in conjunction with the academic advisor, assists the student in the research work required for the thesis. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

Project Option: This option requires 30 credits of course work and 3 credits of project work (CHEN 796). The advisor and student select a suitable project of mutual interest to both. No formal advisory committee is required for the option. The project option may interest those who wish to investigate a specific problem and write a technical report. Of the thirty credit hours of courses, at least twelve credit hours of courses must be at 700 level. Students must take four courses (12 credit hours) from the MSChE core courses. With the approval of the MSChE Director and/or project advisor, a student may take nine credit hours of graduate courses from outside the CHEN Department. In lieu of a final comprehensive examination, project option students must pass a public, oral defense of their project. The defense is evaluated by a committee of at least three faculty who are appointed by the project advisor and the CHEN Director. One of the committee members will be the student's advisor. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

Course Work Option: This option requires 33 credits of course work approved by the advisor and MSChE Director. Of the thirty-three credit hours of courses, at least fifteen credit hours of courses must be at 700 level and at least four courses (12 credit hours) must be from the MSChE core courses. With the approval of the MSChE Director, a student may take nine credit hours of graduate courses from outside the CHEN Department. No formal advisory committee is needed, but the student must select an advisor. Students wishing to receive advanced training without an interest in solving a publishable problem or in writing a technical report will be attracted to this option. Students in this option may be asked to pass a written comprehensive examination. The examination follows the general course material of the student and is written by three or more examiners selected by the CHEN Director; one shall be the advisor. The student must satisfy the majority of examiners to pass the comprehensive examination. The examination is given during the student's final semester.

Advanced Undergraduate/Graduate Courses

Course	Title	Credits (Lec-Lab)
CHEN 600	Advanced Process Control	3 (3-0)
CHEN 605	Biochemical Engineering	3 (3-0)
CHEN 608	Bioseparations	3 (3-0)
CHEN 615	Fuels and Petrochemicals	3 (3-0)
CHEN 618	Air Pollution Control	3 (3-0)
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)
CHEN 622	Pollution Prevention	3 (3-0)
CHEN 625	Basic Food Process Engineering	3 (3-0)
CHEN 630	Transport Phenomena	3 (3-0)
CHEN 635	Mixing Processes and Equipment Scale-up	3 (3-0)
CHEN 640	Computer Aided Process Design	3 (3-0)

CHEN 645	Environmental Remediation	3 (3-0)
CHEN 655	Nanostructured Materials and Engineering Applications	3 (3-0)
CHEN 660	Selected Topics in Chemical Engineering Var.	Var. 1-3
CHEN 665	Introduction to Polymer Science and Engineering	3 (3-0)
CHEN 666	Special Projects in Chemical Engineering	Var. 1-3
CHEN 670	Solids Processing and Particle Technology	3 (3-0)
MCEN 610	Biological Applications of Engineering	3 (3-0)

Graduate Only Courses

CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 730	Advanced Biochemical Engineering	3 (3-0)
CHEN 740	Advanced Chemical Process Design	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)
CHEN 786	Special Chemical Engineering Project	3 (3-0)
CHEN 789	Special Topics	3 (3-0)
CHEN 792	Chemical Engineering Master's Seminar	1 (1-0)
CHEN 793	Master's Supervised Teaching	3 (3-0)
CHEN 794	Master's Supervised Research	3 (3-0)
CHEN 796	Master's Project	3 (3-0)
CHEN 797	Master's Thesis	3 (3-0)

CHEMICAL ENGINEERING COURSES AND DESCRIPTIONS CHEMICAL ENGINEERING GRADUATE/ ADVANCED UNDERGRADUATE COURSES

CHEN-600. Advanced Process Control **Credit 3 (3-0)**

The course covers advanced methods for controlling chemical processes: adaptive control, feed forward control, cascade control, multivariable control, multi-loop control, decoupling, and deadtime compensation. Emphasis is placed on computer design. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-605. Biochemical Engineering **Credit 3 (3-0)**

The course covers basic phenomena involved in biological systems, biochemical reaction systems, microbiology, and biological processes. Application of engineering methods to the design and control of biological systems. Biochemical production of industrial chemicals. Biological waste treatment. Immobilized enzyme technology. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-608. Bioseparations **Credit 3 (3-0)**

The course is an introduction to the separation and purification of biochemicals. Separation processes are characterized as primarily removal of insolubles, isolation of products, purification or polishing. Processes covered include filtration, centrifugation, cell disruption, extraction, absorption, elution chromatography, precipitation, ultrafiltration, electrophoresis and crystallization. Students are required to complete a design project on a bioseparation process. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-615. Fuels and Petrochemicals **Credit 3 (3-0)**

Topics important to the production of fuels are covered. Topics include extraction and processing of fossil fuels, synfuels, and fuels from renewable resources. Topics also include distillation, refining, fermentation, catalytic reactions, and removal of undesirable by-products. The design of fuel processes include emphasis on economic and environmental impact. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-618. Air Pollution Control **Credit 3 (3-0)**

The economic, social and health implications of air pollution and its control are covered. To understand the problems better, the sources, types and characteristics of man-made air pollutants

will be discussed. The course will review some of the main regulations and engineering alternatives for achieving different levels of control. An air pollution control system will be designed. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Course is to be cross-referenced with CIEN 618) (DEMAND)

CHEN-620. Advanced Chemical Engineering Analysis **Credit 3 (3-0)**

Solution of chemical engineering problems by advanced mathematical techniques. Solution of uncoupled and coupled momentum, heat and mass transfer problems. Solution of linearized dynamic equations representing staged operations by matrix analysis. Advanced design and optimization of chemical processes. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-622. Pollution Prevention **Credit 3 (3-0)**

The concept of pollution prevention and its application through industrial ecology, risk assessment and life-cycle assessment methodologies are covered. Topics include pollution prevention at the macroscale (industrial sector), mesoscale (unit operations), and microscale (molecular interactions). A process involving membrane separation steps will be designed and analyzed. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-625. Basic Food Process Engineering **Credit 3 (3-0)**

This course covers basic food processing topics including food preparation operations. Topics included are slurry flow, processing operations, microbiology and health hazards, diseases and medicines, and their effects on humans. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-630. Transport Phenomena **Credit 3 (3-0)**

A unified approach to momentum, energy, and mass transfer with emphasis on the microscopic approach. Development of the differential transport balances. Applications in solving simple chemical process problems. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall)

CHEN-635. Mixing Processes and Equipment Scale-up **Credit 3 (3-0)**

The courses cover practical design concepts of mixing and multi-phase processing in agitated tanks. Strategies for increasing plant throughput, improving contacting and mixing and selecting equipment will be given. This course provides information on: 1) judging the level of difficulty of a mixing process; 2) using practical elements of laminar, transitional and turbulent mixing; 3) mixing times and 4) increasing throughput for all types of systems and power. The course treats jet mixing, gas sparged mixing and mechanical mixing. The course provides basic concepts on using pilot plant studies for process translation and scale-up. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Spring)

CHEN-640. Computer-Aided Chemical Process Design **Credit 3 (3-0)**

The development and use of computer-aided models for process equipment design is stressed. Model results are compared with the ASPEN PLUS simulation package. Students study the interrelationships between design and process variables using computer simulation. Optimization methods are applied to chemical process design. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-645. Environmental Remediation **Credit 3 (3-0)**

The course introduces students to traditional and developmental methods for removal and detoxification of hazardous wastes at contaminated sites and from industrial waste streams. Chemical, thermal, biological and physical methods of remediation are covered. The course deals with hazardous wastes in soils, groundwater, surface water, wastewater ponds and tanks. The emphasis is on destruction, removal and containment methods using mathematical models for contaminant fate and transport. Recent advances in emerging technologies are also discussed. Each student will complete an environmental remediation design project. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-655. Nanostructured Materials and Engineering **Credit 3 (3-0)**

This course reviews and analyzes modern chemical engineering material processing technologies. Chemical vapor deposition, crystallization, electrochemical deposition, electroplating and supercritical fluid-based processing techniques for the production of nanostructured materials are discussed. This course also covers the effects of parameters (such as lattice structure, material composition, nucleation, crystal growth phenomena, chemical bonding, etc.) on the catalytic, electronic, optical and physical properties of metallic and ceramic materials. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-660. Selected Topics in Chemical Engineering **Credit 3 (3-0)**

Topics covered include selected chemical engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-665. Introduction to Polymer Science & Engineering **Credit 3 (3-0)**

This course is an introduction to the fundamentals of polymer science and engineering. Topics included are polymerization reaction mechanisms and kinetics, molecular weight distribution and measurement methods, crystallinity, morphology and phase transitions, structure-property relationships, solution properties and melt rheology. Commonly used polymer characterization techniques will be introduced. Industrial examples will be emphasized. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

CHEN-666. Special Projects in Chemical Engineering **Credit 3 (3-0)**

Study arranged on a special chemical engineering topic of interest to both student and faculty member who will act as supervisor. Topics may be analytical and /or experimental and should encourage independent study. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (Fall, Spring)

CHEN-670. Solids Processing and Particle Technology **Credit 3 (3-0)**

This course is an introduction to the fundamentals of solids processing and particle technology. Topics included are properties of particles, transport of particles, size reduction, size enlargement, filtration, centrifugation, clarification, drying of solids, crystallization, flotation, and safety hazards of fine powders. Industrial examples will be emphasized. Prerequisite: Senior standing in Chemical Engineering or permission of instructor. (DEMAND)

MCEN-610. Biological Applications of Engineering **Credit 3 (3-0)**

This course covers the application of engineering principles and methods to problems in medicine, the integration of engineering with biology, and the emerging industrial opportunities. Examples from a variety of engineering disciplines will be provided. The ethical concerns associated with some emerging life science applications will be explored. Lab experiments will be utilized in the course to provide hands-on experience with life science concepts. Required is a research paper on an emerging application of life science in engineering. Prerequisite: Consent of instructor. (Spring)

CHEMICAL ENGINEERING GRADUATE ONLY COURSES

CHEN-710. Transport Phenomena II **Credit 3 (3-0)**

This course is an advanced treatment of the mechanisms of momentum, heat and mass transport. Emphasis is on methods of solution of transport problems for coupled systems where two or more transport processes interact. Other topics include Non-Newtonian Flow, Boundary Layer Theory, and the Analysis and solution of transport problems of significance in chemical processes. (DEMAND)

CHEN-720. Advanced Chemical Reaction Engineering **Credit 3 (3-0)**

This course includes an advanced treatment of chemical reaction engineering including the effect of non-ideal flow and fluid mixing on reactor design, as well as multi-phase reaction system and heterogeneous catalysis and catalytic kinetics. (Fall)

CHEN-730. Advanced Biochemical Engineering **Credit 3 (3-0)**

This course is the study of advanced topics in biochemical engineering and enzyme engineering, highlighting research trends. Modeling and optimization of biochemical systems are also covered, as well as the design and analysis of enzyme reactors and the use of enzymes in industrial, environmental and medical applications. (DEMAND)

CHEN-740. Advanced Chemical Process Design **Credit 3 (3-0)**

Topics in advanced conceptual process engineering such as process analysis, process synthesis and process optimization are covered. Specific topics include: flowsheeting, design variable selection, computational algorithm formulation, separation sequences, heat exchanger networks, recycle-purge processes, process design and simulation software development, including physical and thermodynamic properties packages. (DEMAND)

CHEN-750. Separation Processes **Credit 3 (3-0)**

Differential and equilibrium stage operations involving non-isothermal and multi-component systems are covered. Other topics covered include simultaneous mass transfer and chemical reaction and dispersion effects. Applications to operations such as absorption, extraction, chromatography, distillation, ion exchange, and membrane separation are also studied. (Spring)

CHEN-760. Advanced Chemical Engineering Thermodynamics **Credit 3 (3-0)**

This is an advanced course covering topics in molecular thermodynamics of fluid phase equilibria. Statistical thermodynamics and thermodynamics of nonequilibrium processes are introduced. (Spring)

CHEN-786. Special Chemical Engineering Project **Credit 3 (3-0)**

The course is intended for students who want to complete an analytical or experimental project of interest to the student and instructor. The course may be completed by Project Option students, but does not substitute for Master's project. (Fall, Spring)

CHEN-789. Special Topics **Credit 3 (3-0)**

A course designed to allow the introduction of potential new courses on a trial basis or the offering of special course topics on a once-only basis. The course may be offered to individuals or groups of students. A definite topic and the title must be agreed upon by the advisor before the student registers for the course. (DEMAND)

CHEN-792. Master's Seminar **Credit 1 (1-0)**

This course provides a forum for the presentation and discussion of selected topics of interest to chemical engineers such as faculty research interests, communication, safety, job prospects and research results. (Fall, Spring)

CHEN-793. Master's Supervised Teaching **Credit 3 (3-0)**

Students will gain teaching experience under the mentorship of a faculty member who assists the student in planning for the teaching assignment, observes and provides feedback to the student during the teaching assignment, and evaluates the student upon completion of the assignment. (DEMAND)

CHEN-794. Master's Supervised Research **Credit 3 (3-0)**

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty. (DEMAND)

CHEN-796. MS Chemical Engineering Project **Credit 3 (3-0)**

This is an independent, analytical or experimental project involving research or design in an area of interest to the instructor and the student. This course must be completed by, and only by, Master of Science in Chemical Engineering (MSChE) project option students. A written proposal must be submitted to outline the project. A written report and an oral defense are required. (Fall, Spring, Summer)

CHEN-797. Master's Thesis **Credit 3 (3-0)**

Master of Science thesis research will be conducted under the supervision of the thesis committee

chairperson leading to the completion of the master's thesis. The course is only available to thesis option students. (Fall, Spring, Summer)

Mechanical Engineering

Leonard C. Uitenham, Chairperson
618 McNair Building
(336) 334-7621

OBJECTIVE

The objective of graduate study in Mechanical Engineering is to provide advanced level study in mechanical engineering in four distinct areas of specialization. The Master of Science in Mechanical Engineering is designed to prepare the graduate for Ph.D. level studies or for advanced mechanical engineering practice in industrial consulting or government service. The Ph.D. degree in Mechanical Engineering provides both advanced instruction and independent research opportunities to students. The Ph.D. degree is the highest academic degree offered, and graduates typically are employed in research environments in government laboratories and industries, and as university faculty.

DEGREES OFFERED

Master of Science in Mechanical Engineering (MSME)
Doctor of Philosophy (Ph.D.) in Mechanical Engineering

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

Program Description

The Master of Science in Mechanical Engineering is a graduate-level program comprising advanced studies in mechanics and materials, energy and thermal/fluid systems, design and manufacturing, and aerospace.

Admission to the MSME Program

The Master of Science in Mechanical Engineering Program is open to students with a Bachelor's Degree in Mechanical Engineering or a closely related field from an institution of recognized standing. Application packages may be obtained from the School of Graduate Studies Office, Room 122, Gibbs Hall, North Carolina A&T State University, Greensboro, NC 27411. Applicants may be admitted to the MSME Program under two categories:

Unconditional Admission or Conditional Admission. Details follow:

1. *Unconditional Admission:* An applicant may be given unconditional admission to the MSME Program if he/she possesses a MSME bachelor's degree from an ABET (Accreditation Board for Engineering and Technology) accredited institution, with an overall GPA of 3.0 or better on a 4.0 scale.

Students admitted on an unconditional basis are also expected to have completed "key courses" below as part of their prior undergraduate program.

Undergraduate Courses Required:

Calculus (minimum of 8 semester hours) Statics

Differential Equations Dynamics

Applied Engineering Mathematics Strength of Materials

Physics (minimum of 6 semester hours) Materials Science

Chemistry Thermodynamics

Fortran Programming Fluid Mechanics

Introductory Numerical Methods Mechanical Engineering Design

Additional undergraduate course requirements for Specialization in Mechanics and Materials: three (3) credits of Advanced Materials

Additional undergraduate course required for Specialization in Energy and Thermal/Sciences: three (3) credits of Heat Transfer

Additional undergraduate courses required for Specialization in Design and Manufacturing: three (3) credits of System Dynamics and three (3) credits of

Manufacturing Processes

2. *Provisional Admission:* Applicants may be granted conditional admission if they do not qualify for unconditional admission due to one or more of the following reasons:
 - a. Applicant has a baccalaureate mechanical engineering degree from a non-ABET accredited program. Undergraduate engineering degrees from foreign universities fall into this category.
 - b. Applicant has a baccalaureate degree in engineering but is deficient in key background courses listed in the previous section. These deficiencies must not exceed 12 credit hours.
 - c. Applicant has an undergraduate degree which is not in engineering but is in a closely related curriculum with a substantial engineering science content. Background deficiencies should not exceed 12 credit hours.
 - d. Applicant's undergraduate grade point average is below that required for unconditional admission but there is also academic evidence that the student will successfully complete the degree.

Provisional admission status will be changed to unconditional when the student has satisfied the two conditions below:

 - a. All required course deficiencies have been completed with a 3.0 GPA or above and
 - b. A minimum of 3.0 GPA is attained on A&T courses taken for graduate credit at the end of the semester in which the 9th semester credit is completed.

Failure to move to unconditional admission when first eligible will result in the student being subject to probation policies. Other admission conditions and program requirements may be imposed on a case-by-case basis as approved by the Dean of the School of Graduate Studies.

Provisional admission status is the minimum level of graduate admission classification. In this classification, students are eligible to register for 700-level courses, provided such courses are approved by the academic advisor.

Change of Admission Status

It is the student's responsibility to apply to the department for a change in admission status. Students who fail to have their status upgraded run the risk of not receiving graduate credit for any completed graduate courses. Such students also run the risk of academic probation and dismissal.

Program Options

1. Course Work Option

This option consists of thirty-three (33) semester hours of course work. Successful completion of the comprehensive examination is a degree requirement. Approval must be obtained from the Graduate Program Coordinator to elect the course work option. A course work Option student must also take at least five courses from her/his specialization area or in a related area as specified by the academic advisor. A candidate who chooses the course work option must select a permanent advisor who will direct the course of study and who will plan the Final Comprehensive Examination. The advisor may also be part of the group of examiners who conduct the Final Comprehensive Examination. A candidate who selects this option does not have a formal advising committee.

Comprehensive Examination (Course work Option)

Candidates who elect the course work option must sit for a written comprehensive examination of six (6) hours duration, prepared as three independent two-hour examinations. A student must have completed at least twenty-one (21) hours of course work to be eligible to take the comprehensive examination.

One week each semester, at least forty-five (45) days prior to the end of the semester, will be designated as Comprehensive Examination Week. All students wishing to take the examination must do so during this period.

Applications to take the examination must be submitted by the academic advisor to the Graduate Program Coordinator at least thirty (30) days prior to the scheduled beginning date of the examination. The student must initiate this process by contacting his/her advisor with an examination request.

The application should contain a description of the subject areas to be covered by the exam. In consultation with the academic advisor, the Graduate Coordinator assigns an appropriate group of examiners as well as a test time and date. The Graduate Program Coordinator will organize the examination to arrange for as much “common” testing as possible based on material relating to the student’s course work.

The candidate must achieve a satisfactory score in at least two (2) sessions of the examination. A candidate who fails to achieve a satisfactory score at the first attempt may sit again in the next regularly scheduled Comprehensive Examination Week, generally in the following semester. A candidate who fails a second time must petition the Dean of the School of Graduate Studies for permission to sit again. An unfavorable decision will result in dismissal from the program. A third failure will always result in dismissal from the program.

2. Project and Thesis Options

The Project Option consists of thirty (30) semester hours of course work and three (3) hours of special project. It is intended for students with an interest in research or independent study but who do not wish to do a full Master’s thesis. Project Option students must take three hours of MEEN-796 Master’s Project. An oral examination project defense/examination is required.

The Thesis Option consists of twenty-four (24) semester hours of course work and six (6) hours of thesis. Thesis Option students must take six hours of MEEN-797 Master’s Thesis. An original research topic must be chosen in conjunction with the student’s advisor culminating in the preparation of a scholarly thesis. An oral thesis defense/examination is required. This option is intended for students with strong research interests who may desire to pursue further graduate studies towards a Ph.D. degree.

THE DOCTOR OF PHILOSOPHY IN MECHANICAL ENGINEERING

Program Description

The Ph.D. degree program in Mechanical Engineering provides both doctoral-level instruction and independent research opportunities for students. The Ph.D. degree is the highest academic degree offered, and graduates typically are employed in research environments in government laboratories and industries, and as University faculty.

The Ph.D. degree program is highly individualistic in nature, and the student is expected to make a significant contribution to the reservoir of human knowledge by investigating a significant topic within the domain of mechanical engineering. The Ph.D. student must rely heavily on the guidance of the academic advisor and on the academic committee in formulating a plan of work, in setting and meeting the degree goals, and in selecting a dissertation problem. The academic advisor serves to guide the student during the dissertation study phase of the program.

For details concerning admission requirements, see Admission and Other Information elsewhere in this catalog.

Ph.D. Program Policies and Requirements

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work of the highest levels without supervision. The degree is therefore not granted simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. As a guide however, the student is expected generally to have completed at least twenty-four (24) course credits beyond the master’s degree and a minimum of twelve (12) dissertation credits. The student must demonstrate both the attainment of scholarship and independent study in a specialized field of study by writing a dissertation reporting the results of an original investigation. The student must pass a series of comprehensive examinations in the field of specialization and related areas of knowledge and defend successfully the quality, methodology, findings, and significance of the dissertation.

Advisory Committee and Plan of Graduate Work

An advisory committee of at least four graduate faculty members, one of whom will be designated as chair, will be appointed by the Dean of the School of Graduate Studies upon the

recommendation of the Chairperson of the department. The committee, which must include at least one representative of the minor field, will, with the student, prepare a Plan of Graduate Study which must be approved by the department and the School of Graduate Studies. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan; any subsequent changes in committee or subject or in the overall plan must be submitted for approval as with the original plan.

The program of study must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor. Normally, a student will select the minor work from a single discipline or field. If the advisory committee finds that the needs of the student will be best served by work in an interdisciplinary minor, it has the alternative of developing a special program in lieu of the usual minor.

OTHER INFORMATION

See "Requirements for the Doctor of Philosophy Degree" elsewhere in this catalog for information related to residence requirements, qualifying examination, preliminary examination, comprehensive examination, final oral examination, admission to candidacy, and time limit. Students should also consult the department handbook for more details.

THE DISSERTATION

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must be a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the School of Graduate Studies. Three copies of the document signed by all members of the student's advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by the School of Graduate Studies to ensure that the format conforms to its specifications.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

Mechanical Engineering Course Summary

COURSE	TITLE
MEEN 602	Advanced Strength of Materials
MEEN 604	Intermediate Dynamics
MEEN 606	Mechanical Vibrations
MEEN 608	Experimental Stress Analysis
MEEN 610	Theory of Elasticity
MEEN 613	Composite Materials
MEEN 614	Mechanics of Engineering Modeling
MEEN 618	Numerical Analysis for Engineers
MEEN 626	Advanced Fluid Dynamics
MEEN 642	Materials Joining
MEEN 645	Aluminum Product Design and Manufacturing
MEEN 646	Advanced Manufacturing Processes
MEEN 647	Computer Integrated Mechanism Design
MEEN 649	Design of Robot Manipulators
MEEN 650	Mechanical Properties and Structure of Solids
MEEN 651	Aero Vehicle Structures II
MEEN 652	Aero Vehicle Stability and Control
MEEN 653	Aero Vehicle Flight Dynamics
MEEN 654	Advanced Propulsion
MEEN 655	Computational Fluid Dynamics
MEEN 656	Boundary Layer Theory
MEEN 657	Design of Thermal Systems

MEEN 660	Selected Topics in Engineering
MEEN 663	Energy Conversion Systems Design
MEEN 667	Environmental Control
MEEN 668	Gas Dynamics
MEEN 670	Internal Combustion Engines
MEEN 671	Turbo machinery
MEEN 675	Solar Energy Fundamentals and Design
MEEN 702	Continuum Mechanics
MEEN 706	Theory of Vibrations
MEEN 707	Real Time Analysis of Dynamic Systems
MEEN 716	Finite Element Methods
MEEN 719	Advanced ComputerAided Design
MEEN 731	Conduction Heat Transfer
MEEN 732	Convection Heat Transfer
MEEN 733	Radiation Heat Transfer
MEEN 742	Tools, Jigs, and Fixtures
MEEN 743	Instrumentation
MEEN 785	Special Topics
MEEN 792	Master's Seminar
MEEN 796	Master's Project
MEEN 793	Master's Supervised Teaching
MEEN 794	Master's Supervised Research
MEEN 797	Master's Thesis
MEEN 804	Advanced Dynamics
MEEN 808	Energy Methods in Applied Mechanics
MEEN 810	Advanced Theory of Elasticity
MEEN 813	Composite Structures
MEEN 814	Mathematical Theory of Plasticity
MEEN 820	Advanced Classical Thermodynamics
MEEN 822	Statistical Thermodynamics
MEEN 824	Irreversible Thermodynamics
MEEN 834	Special Topics in Applied Heat Transfer
MEEN 838	Solar Thermal Energy Systems
MEEN 840	Machine Tool Design
MEEN 846	Stochastic Modeling of Mechanical Systems
MEEN 847	Computational Engineering Dynamics
MEEN 848	Digital Control of Machines and Processes
MEEN 849	Computer Control of Robot Manipulators
MEEN 850	Phase Equilibria
MEEN 858	Mechanical Metallurgy
MEEN 860	Fracture Mechanics
MEEN 885	Special Topics
MEEN 992	Doctoral Seminar
MEEN 993	Doctoral Supervised Teaching
MEEN 994	Doctoral Supervised Research
MEEN 995	Doctoral Preliminary Examination
MEEN 997	Doctoral Dissertation
MEEN 999	Continuation of Thesis/Dissertation for Mechanical Engineering

MECHANICAL ENGINEERING COURSE DESCRIPTIONS

MEEN-602. Advanced Strength of Materials

Credit 3 (3-0)

This course covers stress-strain relations as applied to statically indeterminate structures, bending in curved bars, plates, shells, and beams on elastic foundations. Topics include: strain energy concepts for formulation of flexibility matrix on finite elements, bending in beams and plates, Cartesian tensor notation, and matrix structural analysis. Prerequisites: MEEN 336, MATH 432 or equivalent.

MEEN-604. Intermediate Dynamics **Credit 3 (3-0)**

This course reviews particle and system dynamics, and introduces rigid body dynamics with solution techniques for the non-linear systems of ordinary differential equations as initial value problems. Other topics covered include: angular and linear momentum, energy and Lagrangian methods of body problems, generalized variables, small vibrations, and gyroscopic effects and stability. Prerequisites: MEEN 337, MATH 432 or equivalent.

MEEN 606. Mechanical Vibrations **Credit 3(3-0)**

This is a course in modeling, analysis and simulation of free and forced vibrations of damped and undamped, single and multi-degree of freedom systems. Prerequisites: MEEN 440 and MATH 431.

MEEN-608. Experimental Stress Analysis **Credit 3 (3-0)**

Principles and methods of experimental stress analysis are covered in this course. Photo-elastic and micromasurement techniques applied to structural models are also addressed. Prerequisites: AREN 457 or MEEN 602 or equivalent.

MEEN-610. Theory of Elasticity **Credit 3 (3-0)**

This course introduces stress, strain-strain relations, energy principles, and other related topics. Prerequisites: MATH 432, MEEN 336 or equivalent.

MEEN-613. Composite Materials **Credit 3 (2-2)**

This course introduces the processing of fiber-reinforced composite materials, anisotropic theory, and test methods for composites. Topics include different methods of processing polymeric composites, process control parameters, anisotropic constitutive equations, classes of anisotropy and associated elastic constants, micromechanics models, theories of failure, test methods, classical laminate theory, and special types of laminates. The concepts are applied to the design of simple composite structural components. This course includes a laboratory component for students to learn processing and testing of composite materials. Prerequisites: MEEN 260 and MEEN 336 or their equivalents.

MEEN-614. Mechanics of Engineering Modeling **Credit 3 (3-0)**

This is a course in engineering modeling techniques including time dependent integration simulation models of systems, and finite difference and finite element methods in mechanics. Prerequisites: MEEN 210, MEEN 336, MATH 432 or equivalent.

MEEN-618. Numerical Analysis for Engineers **Credit 3 (3-0)**

This course is a study of scientific programming, error analysis, matrix algebra, eigenvalue problems, curve-fitting approximations, interpolation, numerical differentiation and integration, solutions to simultaneous equations, and numerical solutions of differential equations. Prerequisite: MEEN 210 or equivalent.

MEEN-626. Advanced Fluid Dynamics **Credit 3 (3-0)**

This course presents an overview of Navier-Stokes Equations, continuity equation, energy equation, inviscid flow, potential theory, complex potentials, and conformal mapping. Prerequisite: MEEN 416 or equivalent.

MEEN-642. Materials Joining **Credit 3 (3-0)**

This course covers theories and applications of joining of metals, ceramics, and plastics by the standard industrial techniques: arc, gas, electron beam, laser, ultrasonic, and diffusion bonding. Additional topics covered include: phase diagrams, diffusion equations, and physical/chemical properties in joining considerations. Prerequisites: MEEN 446 and MATH 432 or equivalent.

MEEN-645. Aluminum Product Design and Manufacturing **Credit 3 (3-0)**

This course introduces students to the principles of product and manufacturing process design specifically applicable to aluminum-based materials. Material properties of aluminum are compared with those of other commercial materials. Raw material fabrication and product manufacturing processes are presented. The interactions between processes and material properties

are described. Case studies are presented to guide the student in successful completion of design projects. Prerequisites: MEEN 260 and MEEN 474.

MEEN-646. Advanced Manufacturing Processes **Credit 3 (3-0)**

Theory, application, and design considerations for forming and machining are covered in this course. Additional topics covered include: machines and tooling in modern manufacturing processes, dimensional and tolerance analysis, and control of work piece and tool. Design projects of molds, dies, presses, jigs and fixtures or automated machinery are required. Prerequisites: MEEN 446, MEEN 474, MATH 231, or equivalent.

MEEN-647. Computer Integrated Mechanism Design **Credit 3 (3-0)**

This is a course in modern computer simulation tools and the underlying theories for synthesis and analysis of mechanical systems consisting of linkages, cams, and gears. Prerequisite: MEEN 440.

MEEN-648. Computer Controlled Manufacturing **Credit 3 (3-0)**

This course introduces students to computer integrated manufacturing, numerical control and group technology. Topics include: manufacturing process interfacing, discrete process modeling, analysis and control techniques and algorithms, characteristics and software of control computers, sensors for computer control, programmable controllers, and sequential control. Prerequisites: MEEN 446, MATH 331, or consent of the instructor.

MEEN-649. Design of Robot Manipulators **Credit 3 (3-0)**

This course covers fundamentals of kinematics, dynamics, computer graphics, sensing devices, measurements and control in robot manipulators. Prerequisites: MEEN 440 or equivalent.

MEEN-650. Mechanical Properties and Structure of Solids **Credit 3 (3-0)**

This course examines the elastic and plastic behavior of matter in relation to its structure, both macroscopic and microscopic. Major representative classes of materials to be examined are thermoplastic materials, elastomers, glasses, ceramics, metals, and composites. Prerequisite: MEEN 460 or equivalent.

MEEN-651. Aero Vehicle Structures II **Credit 3 (3-0)**

This course covers deflection of structures, indeterminate structures, fatigue analysis, and minimum weight design. Finite element methods and software are utilized. Prerequisite: MEEN 422.

MEEN-652. Aero Vehicle Stability and Control **Credit 3 (3-0)**

This course covers longitudinal, directional, and lateral static stability and control of aerospace vehicles. It also covers linearized dynamics analysis of the motion of a six degree-of-freedom flight vehicle in response to control inputs and disturbance through the use of the transfer function concept, plus control of static and dynamics behavior by vehicle design (stability derivatives) and/or flight control systems. Prerequisites: MEEN 415, MEEN 422, and ELEN 410.

MEEN-653. Aero Vehicle Flight Dynamics **Credit 3 (3-0)**

This course covers the basic dynamics of aerospace flight vehicles including orbital mechanics, interplanetary and ballistic trajectories, powered flight maneuvers and spacecraft stabilization. Prerequisites: MATH 432, MEEN 337, and MEEN 422.

MEEN-654. Advanced Propulsion **Credit 3 (3-0)**

This course is a second course in propulsion. It covers the analysis and design of individual components and complete air-breathing propulsion systems including turbo fans, turbo jets, ram jets, and chemical rockets. Prerequisite: MEEN 576.

MEEN-655. Computational Fluid Dynamics **Credit 3 (3-0)**

This course provides an introduction to numerical methods for solving the exact equations of fluid dynamics. Finite difference methods are emphasized as applied to viscous and inviscid flows over bodies. Students are introduced to a modern computational fluid dynamics computer code. Prerequisites: MATH 432 and MEEN 415 or MEEN 416.

MEEN-656. Boundary Layer Theory **Credit 3 (3-0)**

This course covers the fundamental laws governing flow of viscous fluids over solid boundaries. Exact and approximate solutions are studied for various cases of boundary layer flow including laminar, transitional and turbulent flow. Prerequisite: MEEN 415 or 416.

MEEN-657. Design of Thermal Systems **Credit 3 (3-0)**

This is a course in the selection of components for fluid and energy processing systems to meet system performance requirements. Computer-aided thermal design, simulation and optimization techniques, and investment economics are discussed. Design projects are assigned to demonstrate application of these topics. Prerequisites: MEEN 562 and INEN 260.

MEEN-660. Selected Topics in Engineering **Credit 3 (3-0)**

This course consists of selected mechanical engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Consent of instructor.

MEEN 663. Energy Conversion Systems Design **Credit 3 (3-0)**

This course covers the design of steam power systems, internal combustion power systems, refrigeration and heat pump systems, and an overview of direct energy conversion devices. Power system design projects are assigned. Prerequisites: MEEN 416 and MEEN 442.

MEEN 667. Environmental Control **Credit 3 (3-0)**

This course deals with the principles of heating and air conditioning and their applications to design of environmental control systems and determination of building heating and cooling loads. Principal equipment, layout and control are discussed for various types of systems. Prerequisites: MEEN 442 and MEEN 562.

MEEN 668. Gas Dynamics **Credit 3 (3-0)**

The course covers the principles of one-dimensional compressible fluid flow, normal shocks, and flow with friction, heating, and cooling. Two-dimensional flows are also introduced. Prerequisites: MEEN 415 or MEEN 416 and MEEN 441.

MEEN 670. Internal Combustion Engines **Credit 3 (3-0)**

This course deals with the fundamental principles of spark-ignition and compression ignition engines, combustion phenomena, the effect of fuel-air mixture, design of components of an internal combustion engine, and testing and performance curves. Design projects are assigned. Prerequisite: MEEN 442.

MEEN 671. Turbomachinery **Credit 3 (3-0)**

This course covers the application of the cascade method to turbomachines, impulse and reaction turbines, compressible fluid dynamics, gas turbine principles, pumps, compressors and blowers, and the design of turbine elements. Project work is assigned. Prerequisites: MEEN 415 or MEEN 416 and MEEN 442.

MEEN 675. Solar Energy Fundamentals and Design **Credit 3 (3-0)**

This course deals with the characterization of solar radiation at the earth's surface. Solar collectors of both flat and concentrating types, and storage and distribution systems are discussed and analyzed. System sizing, design and economic analysis for space heating, water heating and industrial process are covered. Prerequisite: MEEN 562.

MEEN-702. Continuum Mechanics **Credit 3 (3-0)**

This course covers the applications of the laws of mechanics and thermodynamics to the continuum. Topics include a rigorous development of the general equations applied to a continuum and the application and reduction of the general equations for specific cases of both solids and fluids. Prerequisite: MEEN 336 or equivalent.

MEEN-706. Theory of Vibrations**Credit 3 (3-0)**

Vibration analysis of systems with one-, two- or multi-degrees of freedom are introduced in this course. Topics include instrumentation, continuous systems, and computer techniques. Prerequisites: MEEN 440, MATH 432, and MEEN 606.

MEEN-707. Real Time Analysis of Dynamic Systems**Credit 3 (3-0)**

This course covers the theory and application of real time analysis (RTA) used in system identification and machinery fault detection. RTA applications in production engineering and product development are addressed to study short-lived events or to analyze system operation in time domain or frequency domain to identify system characteristics or possible problems. Prerequisite: Consent of instructor.

MEEN-716. Finite Element Methods**Credit 3 (3-0)**

This course covers fundamental concepts of the finite element method for linear stress and deformation analysis of mechanical components. Topics include the development of truss, beam, frame, plane stress, plane strain, axisymmetric isoparametric, solid, thermal, and fluid elements. ANSYS and NASTRAN software will be used for solving practical stress analysis problems. Prerequisite: Consent of instructor.

MEEN-719. Advanced Computer-Aided Design**Credit 3 (3-0)**

This course covers important methods and techniques for using the computer to aid the design process. Simulation and optimization methods are applied to the design of mechanical systems. Prerequisite: Consent of instructor.

MEEN-731. Conduction Heat Transfer**Credit 3 (3-0)**

This course presents the development of the general heat conduction equation and its applications to one-, two-, and three-dimensional steady and unsteady boundary value problems. Closed form and numerical solution techniques are addressed. Prerequisite: MEEN 562 or equivalent.

MEEN-732. Convection Heat Transfer**Credit 3 (3-0)**

This course presents the analysis of heat convection in laminar and turbulent boundary layer and pipe flow. Topics include: dimensional analysis, free convection, condensation, and boiling. Prerequisite: MEEN 562 or equivalent.

MEEN-733. Radiation Heat Transfer**Credit 3 (3-0)**

A comprehensive treatment of basic theories is reviewed in this course. Topics include: radiation characteristics of surfaces, radiation properties taking account of wave length and direction, and analysis of radiation exchange between idealized and real surfaces. The course also addresses fundamentals of radiation transfer in absorbing, emitting, and scattering media. The interaction of radiation with conduction and convection is discussed. Prerequisite: MEEN 562 or equivalent.

MEEN-742. Tools, Jigs, and Fixtures**Credit 3 (3-0)**

This course covers tool design methods, tool-making practices, tool materials and heat treatments, and plastics for tool materials. Additional topics covered include: design of cutting tools for N/C machine tools, design of size and fixture, basics of clamping, and chucking and indexing for various machining processes. Prerequisites: MEEN 460, MATH 432 or equivalent.

MEEN-743. Instrumentation**Credit 3 (3-0)**

Principles and practices of industrial measurement are presented in this course. Topics include: instrument dynamics and response characteristics; theory of transducers for temperature, pressure, flow, motion, force; and other physical phenomena. Special topics in instrumentation, data acquisition and data reduction are covered. A project is assigned in an instrumentation application. Prerequisites: Consent of instructor.

- MEEN-785. Special Topics** **Credit 3 (3-0)**
 This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the Master's level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor.
- MEEN-792. Master's Seminar** **Credit 1 (1-0)**
 This course provides a forum for discussions and reports of subjects in mechanical engineering and allied fields. Prerequisite: Master's level standing.
- MEEN-793. Master's Supervised Teaching** **Credit 3 (3-0)**
 Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Master's level standing.
- MEEN-794. Master's Supervised Research** **Credit 3 (3-0)**
 This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project nor thesis topic of the master's student. Prerequisite: Consent of instructor.
- MEEN-796. Master's Project** **Credit 3 (3-0)**
 The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project must be submitted for approval. This course is only available to project option students. Prerequisite: Master's level standing.
- MEEN-797. Master's Thesis** **Credit 3 (3-0)**
 Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Master's thesis. This course is only available to thesis option students. Prerequisite: Consent of advisor.
- MEEN-804. Advanced Dynamics** **Credit 3 (3-0)**
 This course covers Lagrange's equations of motion as applied to rigid body dynamics. Topics include: generalized coordinates, generalized conservative and dissipative forces, degrees of freedom, holonomic constraints as related to rigid body motion, calculus of variations, and Hamilton's equations of motion. Prerequisite: MEEN 604 or equivalent.
- MEEN-808. Energy Methods in Applied Mechanics** **Credit 3 (3-0)**
 The use of energy methods in solving applied mechanics problems is presented in this course. Applications in beams and frames, deformable bodies, plates and shells, and buckling are addressed. Variational methods are also discussed. Prerequisite: MEEN 610 or equivalent.
- MEEN-810. Advanced Theory of Elasticity** **Credit 3 (3-0)**
 This is a course in strains, stresses, and the equations of elasticity. Topics include general formulation of the 2-D boundary value problems and the formulation of certain three-dimensional problems with symmetry. Prerequisite: MEEN 610 or equivalent.
- MEEN-813. Composite Structures** **Credit 3 (3-0)**
 This course focuses on the application of composite materials to the design and analysis of structures. The topics covered are two- and three-dimensional hydrothermal anisotropic elastic constitutive equations; classical laminate theory; static stress, vibration, and buckling analysis of laminated beams and plates; environmental effects; and fatigue and fracture of laminated composites. Prerequisite: MEEN 613 or equivalent.
- MEEN-814. Mathematical Theory of Plasticity** **Credit 3 (3-0)**
 This course covers stress and strain tensors, transformations and equilibrium, and elastic behavior. Topics include: theories of strength, plastic stress/strain, classical problems of plasticity, including thick-walled pressure vessels and rotating cylinders in elastic-plastic conditions, and slip line theory with applications. Prerequisite: MEEN 610 or equivalent.

- MEEN-820. Advanced Classical Thermodynamics** **Credit 3 (3-0)**
 This course covers conditions of equilibrium, processes and thermodynamic systems, first and second order phase transitions, and Nernst Postulate. Prerequisite: MEEN 442 or equivalent.
- MEEN 822. Statistical Thermodynamics** **Credit 3 (3-0)**
 Statistical mechanics and macroscopic properties from statistical methods are presented in this course. Topics include: equilibrium information, generalized coordinates, and general variables. Prerequisite: MEEN 442 or equivalent.
- MEEN-824. Irreversible Thermodynamics** **Credit 3 (3-0)**
 This course is a study of processes which are inherently entropy producing. Topics include: development of general equations for the theory of minimum rate of entropy production, mechanical processes, life processes, and astronomical processes. Prerequisite: MEEN 820 or equivalent.
- MEEN-834. Special Topics in Applied Heat Transfer** **Credit 3 (3-0)**
 Selected special topics in applied heat transfer are presented in this course. Topics include: heat exchanger design and performance, cooling of electronic equipment, and advanced thermal insulation systems. Prerequisite: MEEN 562 or equivalent.
- MEEN-838. Solar Thermal Energy Systems** **Credit 3 (3-0)**
 Characteristic of extraterrestrial and terrestrial solar radiation transfer are presented in this course. Topics include: analysis of thermal performance of concentrating and non-concentrating solar collectors, thermal energy storage systems and energy transport systems, and life cycle cost analysis of solar energy systems. Computer simulation software is introduced. Prerequisites: MEEN 731 and MEEN 732 or equivalent.
- MEEN-840. Machine Tool Design** **Credit 3 (3-0)**
 This course presents general features and requirements of machine tools and design principles. Topics include: static and dynamic stiffness and rigidity, cutting forces, machine tool vibrations, stability against chatter, damping and dampers, transmission of motion, and standardization of speed change gears. This course will cover the design of constructional elements: bearings, electrical components, pneumatics, hydraulics, material selection, and main spindle layouts. Prerequisites: MEEN 565 and MEEN 646 or equivalent.
- MEEN-846. Stochastic Modeling of Mechanical Systems** **Credit 3 (3-0)**
 This course introduces an engineering approach to the analysis of time series and discrete linear transfer function models. Applications include the analysis of experimental data for system modeling, identification, forecasting, and control. Prerequisite: Consent of advisor.
- MEEN-847. Computational Engineering Dynamics** **Credit 3 (3-0)**
 This course introduces computer-oriented methods for the analysis and design of engineering dynamic systems. Topics include: analytical and experimental techniques for model development, design refinement of components in flexible dynamics systems (machine tools, robots, moving vehicles, etc), and optimization techniques for transient response analysis on both constrained and unconstrained systems. Prerequisite: Consent of instructor.
- MEEN-848. Digital Control of Machines and Processes** **Credit 3 (3-0)**
 This course covers control algorithms and design of discrete controllers. Interfaces and command generation for machines and process control are treated. Applications in numerically controlled machines and industrial robots are covered. Prerequisite: MEEN 648.
- MEEN-849. Computer Control of Robot Manipulators** **Credit 3 (3-0)**
 This course covers basic and adaptive robot control systems, sensory requirements and capabilities, and robotic system diagnosis and applications. Prerequisite: MEEN 649 or Consent of instructor.

MEEN-850. Phase Equilibria **Credit 3 (3-0)**

This course presents interpretation and mathematical analysis of unary, binary and ternary, inorganic, phase equilibria systems with examples for solving practical materials science problems. Topics include: isoplethal and isothermal sections, crystallization paths, and thermodynamic fundamentals. Prerequisite: Consent of instructor.

MEEN-858. Mechanical Metallurgy **Credit 3 (3-0)**

This course covers continuum mechanics and the microscopic basis of plastic behavior. Emphasis is on the development and use of dislocation theory. Prerequisite: Consent of instructor.

MEEN-860. Fracture Mechanics **Credit 3 (3-0)**

This course introduces the student to the concept of stress and strain singularities and their effect on fracture strength and fatigue life of isotropic and anisotropic materials. Topics covered include: computation of the stress-strain field around a crack-tip, stress-intensity-factor, strain energy release rate, J-integral, fracture toughness, residual strength, and fatigue crack propagation life. The course concepts are applied to the design of damage tolerant structures. Prerequisite: MEEN-460 or equivalent.

MEEN-885. Special Topics **Credit 3 (3-0)**

This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the doctorate level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor.

MEEN-992. Doctoral Seminar **Credit 1 (1-0)**

In this course, doctoral students attend colloquia or seminars. They consist of presentations by doctoral students on dissertation topics and works-in-progress and by guests on important classical, contemporary, or research problems in mechanical engineering. Prerequisite: Doctoral level standing.

MEEN-993. Doctoral Supervised Teaching **Credit 3 (3-0)**

This course is designed to introduce the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Doctoral students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Others planning to undertake a teaching career are also strongly encouraged to take it. Topics covered include: course planning, classroom teaching, lecture preparation, student evaluation, and grading. The supervisor(s) will observe and provide feedback to the student and evaluate the student's performance. Prerequisite: Doctoral level standing.

MEEN-994. Doctoral Supervised Research **Credit 3 (3-0)**

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisite: Consent of instructor.

MEEN-995. Doctoral Preliminary Examination **Credit 3 (3-0)**

This is required of students who have completed the qualifier examination and who are taking the preliminary examination during the semester. This is a supervised program to help prepare the student for the preliminary examination under the mentorship of the academic advisor. Prerequisite: Doctoral level standing.

MEEN-997. Doctoral Dissertation **Credit 3 (3-0)**

This supervised research serves as the dissertation of the doctoral student. Twelve credits of dissertation are required for graduation. Prerequisites: Doctoral standing and consent of advisor.

MEEN-999. Continuation of Thesis/Dissertation for Mechanical Engineering **Credit 1 (1-0)**

The course is for master's and doctoral students who have completed all required credit hour requirements. Prerequisite: Completion of all Thesis/Dissertation Credits.

Natural Resources and Environmental Design

G. B. Reddy, Chairman
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OBJECTIVES

The Department of Natural Resources and Environmental Design offers a program leading to the Master of Science Degree in Plant, Soil and Environmental Science. Students may select any concentration in Applied Environmental Biology, Land Use and Management, Soil and Sustainable Fertility, Applied Environmental Chemistry, Soil Mineralogy, Soil and Water Conservation, Environmental Horticulture, Plant Biotechnology, Constructed Wetlands, and Mushroom Biology. The objective of the program is to prepare students with the expertise needed to assume technical, teaching, research, and extension positions in universities, industries, and state/federal governments.

Master of Science - DEGREE OFFERED

Master of Science – Plant, Soil and Environmental Science

GENERAL PROGRAM REQUIREMENTS

The admission of students to the graduate degree program in the Department of Natural Resources and Environmental Design is concurrent with the general admission requirements of the University. For other requirements refer to the graduate catalog.

DEPARTMENTAL REQUIREMENTS

Candidate should have a Baccalaureate degree from an accredited undergraduate institution. A bachelor's degree in Agriculture is not required if the student has had adequate training in the basic sciences. The candidate should have a grade point average of 3.0 either in science and mathematics courses, or an overall undergraduate GPA of at least 2.6 (on a 4.0 scale). Additionally, the candidates should have the following required courses and credits or their equivalent.

Chemistry	12 credit hours
Biology	12 credit hours
Mathematics and Calculus	6 credit hours
Physics	3 credit hours
Soil and Plant Science	3 credit hours

Students who have not completed the required or equivalent courses at the undergraduate level, but have satisfied all other requirements for admission will be granted provisional or conditional admission and allowed to make up the deficiencies in the first two semesters. The students lacking adequate background in soil science, plant science or environmental science should take 6 credits in the deficient concentration.

Thesis Option

This option consists of a minimum of 30 semester hours at the 600 and 700 levels and completion of a thesis. A student receives 6 semester hours credit for thesis.

Non-thesis Option

This option consists of a minimum of 33 semester hours at 600 and 700 levels, and completion of a project report. The student pursuing the Master of Science degree in Plant, Soil and Environmental Science is required to complete a common core of courses consisting of 10 hours of the following courses: A student must take courses marked with asterisk (*).

*HORT 700	Plant Biotechniques (Plant Science Option) 3 (1-4)
*SLSC 632	Soil Physics (Soil Science Option) 3 Semester Hours

*AGRI 604	Experiment Methods in Research 3 Semester Hours
*SLSC 717	Methodology in Soil, Plant, and Water Analysis 3 Semester Hours
*NARS 720	Graduate Seminar in Natural Resources 1 Semester Hour

Students pursuing the M.S. in Plant, Soil and Environmental Science are required to spend a minimum of two years to complete course work and a problem in applied research. In addition, a minimum of 16 semester hours is required by area of concentration.

Courses offered in Plant, Soil and Environmental Science - M.S. Program

Courses		Credits
AGEN 600	Soil and Water Engineering I	3 (2-2)
AGEN 624	Water Resources Engineering	3 (2-2)
AGEN 701	Soil and Water Design	3 (2-2)
AGEN 714	Applied Hydrogeology	3 (2-2)
AGRI 604	Experiment Methods in Research	3 (3-0)
AGRI 799	Thesis Research in Agriculture and Environmental Science	6 (6-0)
AGRI 999	Continuation of Thesis	1 (1-0)
EASC 622	Environmental Sanitation and Waste Management	3 (2-2)
EASC 624	Earth Science, Geomorphology	3 (2-2)
EASC 625	Earth Resources	3 (2-2)
EASC 644	Problem Solving in Earth Science	3 (2-2)
EASC 666	Earth System Science	3 (2-2)
EASC 699	Environmental Problems	3 (3-0)
EASC 708	Conservation of Natural Resources	3 (3-0)
EASC 718	Applied Environmental Microbiology	3 (2-2)
HORT 600	Plant Tissue Culture	3 (2-2)
HORT 611	Commercial Greenhouse Production	3 (2-2)
HORT 620	Vegetable Production	3 (2-2)
HORT 700	Plant Biotechniques	3 (1-4)
NARS 608	Special Problems in Natural Resources	3 (3-0)
NARS 610	Applied Spatial Statistics and GIS	3 (2-2)
NARS 618	General Forestry and Ecology	3 (2-2)
NARS 720	Graduate Seminar in Natural Resources	1 (1-0)
NARS 777	Special Problems in Plant Sciences Graduate Studies	3 (3-0)
SLSC 621	Soil Microbiology	4 (2-4)
SLSC 632	Soil Physics	3 (2-2)
SLSC 633	Soil Genesis, Classification and Land Use	4 (2-4)
SLSC 634	Soil Environmental Chemistry	4 (3-2)
SLSC 640	Wetland Management	3 (3-0)
SLSC 710	Soils of North Carolina	3 (2-2)
SLSC 715	Soil Mineralogy	3 (3-0)
SLSC 717	Methodology in Soil, Plant and Water Analysis	3 (0-6)
SLSC 727	Soil Fertility and Plant Nutrition	3 (3-0)
SLSC 734	Applied Environmental Chemistry	4 (4-0)

COURSES WITH DESCRIPTION IN

NATURAL RESOURCES AND ENVIRONMENTAL DESIGN

Plant, Soil and Environmental Science

Advanced Undergraduate and Graduate

AGEN-600. Soil and Water Engineering I

Credit 3 (2-2)

This course will illustrate measures to improve soil and water use by evaluating and using present conservation practices and models. Water conveying and retaining structures, and soil conservation, drainage and irrigation systems will be discussed and designed. The course will emphasize sound environmental design practices. Prerequisite: AGEN 360 or Consent of instructor. (F)

AGEN-624. Water Resources Engineering

Credit 3 (2-2)

Analysis and design of water resources systems. Topics include: water resources planning, and

development, hydraulic structures, introduction to aquifer analysis and contamination, well development, pump evaluation and selection, water quality and management, water laws, detention and retention ponds, wastewater management and remediation.

AGRI-604. Experiment Methods in Research **Credit 3 (3-0)**

Experimental design, methods and techniques of experimentation, application of experimental design to plant, animal and food research; and interpretation of experimental data will be included in the course. Prerequisite (Math 224)

EASC-622. Environmental Sanitation and Waste Management **Credit 3 (2-2)**

This course is the study of traditional and innovative patterns as well as problems of managing with handling waste products of urban and rural environments, their renovation and reclamation. (F)

EASC-624. Earth Science, Geomorphology **Credit 3 (2-2)**

This course examines various land forms and their evolution – the naturally evolved surface features of the Earth’s crust and the processes responsible for their evolution, their relation to man’s activities and as the foundation for understanding the environment. (F)

EASC-625. Earth Resource **Credit 3 (2-2)**

Conservation, management and use of renewable and nonrenewable resources and their impact on the social and economic quality of our environment. (F)

EASC-644. Problem Solving in Earth Science **Credit 3 (3-0)**

Independent field and/or laboratory research in earth and environment science for advanced students is/or required. (S)

EASC-666. Earth System Science **Credit 3 (3-0)**

This course is the study of the earth as a “system” with emphasis on the atmosphere, biosphere, hydrosphere, and lithosphere interactions as related to global change and human activities. (F)

EASC-699. Environmental Problems **Credit 3 (3-0)**

This course provides multidisciplinary examination of environmental problems and application of appropriate techniques of analysis to selected problems. Team taught by environmental faculty. (S)

HORT 600. Plant Tissue Culture **Credit 3 (2-2)**

Theory and principles of plant cell, tissue and organ culture, and their application in crop improvement will be studied. Prerequisites: NARS 110 and HORT 334. (S)

HORT 611. Commercial Greenhouse Production **Credits 3 (2-2)**

The culture of floriculture crops in the greenhouse with emphasis on seasonal production, marketing, insect and disease controls and plant growing structures will be studied. Prerequisites: HORT 334 and 610. (S)

HORT 620. Vegetable Production **Credit 3 (2-2)**

This course provides a comprehensive study of major and minor vegetable crops of North Carolina, the United States, and the world in relation to the industry, production practices, crop development, nutritional value, quality characteristics, marketing, and post-harvest handling and storage. Prerequisites: NARS 110 and SLSC 338. (F)

NARS 608. Special Problems in Natural Resources **Credit 3 (3-0)**

This course is designed for students who desire to study special problems in Natural Resources; plant, soil, and environment. (F, S)

NARS 610. Applied Spatial Statistics and GIS **Credit 3 (3-0)**

This course introduces spatial statistical analysis techniques, which provide the students with the opportunity to conduct exploratory spatial data analysis with ArcView GIS, S-PLUS/ SpatialStats and the SAS/GIS Software. The focus of this course is on effective application of spatial data analysis in GIS environment; MATH 224 and GIS software or consent of instructor. (DEMAND)

NARS-618. General Forestry and Ecology **Credit 3 (2-2)**
History, classification, culture, and utilization of native trees, with special emphasis on their importance as a conservation resource and the making of national forestry policy, and the ecological impact of trees on environmental quality. Prerequisite: Botany-140.

SLSC-621. Soil Microbiology **Credit 4 (2-4)**
A study of soil micro and macro organisms and their role in elemental cycles, environmental pollution remediation and crop yields. Also, deals with the rhizosphere ecology and processes. Organic matter accumulation and carbon.

SLSC-632. Soil Physics **Credit 3 (2-2)**
This course is a study of fundamental physical principles and laws that govern the behavior of soils. Physical constitution of soil water, soil air and the relationship of soil physical conditions to plant growth and engineering usage will also be studied. Prerequisites: SLSC 338, CHEM 102, and MATH 113, and consent of instructor. (S)

SLSC-633. Soil Genesis, Classification and Land Use **Credit 4 (2-4)**
Factors and processes of soil formation, grouping of soils based on their properties, soil mapping, soil interpretations for various uses and discussion of new concepts in soil taxonomy. Prerequisite: SLSC 338.

SLSC-634. Soil Environmental Chemistry **Credit 4 (3-2)**
This course is a study of the chemical properties of soil environment including interactions of solid, liquid and gaseous phases. Discussion will also include ion and pollutant interactions with soil, their retention, potential movement and environmental impact. Additional discussion will include oxidation and reduction, soil acidity and alkalinity and their impact on waste management, resource utilization and the environment. (S)

SLSC-640. Wetland Management **Credit 3 (3-0)**
Designed to provide a basic understanding of benefits that wetlands in their natural conditions offer mankind, fish and wildlife habitat, water quality improvement, flood protection, filter traps for pollutants, erosion control, natural products, recreation, and aesthetics. Primary instructional areas include wetland ecology, wetland systems of the southeast region, wetland law and regulations, soil conditions of wetlands, hydrology of wetlands, methodology of delineating wetlands, wetland irrigation, plant and vegetation identification, and writing environmental reports.

GRADUATE STUDENTS ONLY

HORT-700. Plant Biotechniques **Credit 3 (1-4)**
Fundamentals of biotechniques in plant cell and tissue culture. These techniques are organogenesis, somatic embryogenesis isolation of plant cellular and plasmid DNA, RNA transformation and ELISA.

AGEN-701. Soil and Water Engineering II **Credit 3 (3-0)**
The design of drainage and irrigation systems and their applicability to specific regions will be addressed. There will be in-depth discussion of saturated and un-saturated flow, and various equations used to solve soil water movement. Open channel flow, well hydraulics, and earth dams or embankments will be covered. Prerequisite: AGEN-600 or consent of the instructor.

EASC-708. Conservation of Natural Resources **Credit 3 (3-0)**
A descriptive course dealing with conservation and development of renewable natural resources encompassing soil, water, and air; cropland, grassland, and forests; livestock, fish, and wildlife; and recreational, aesthetic and scenic values. Attention will be given to protection and development of the nation's renewable natural resources base as an essential part of the national security, defense, and welfare.

SLSC-710. Soils of North Carolina **Credit 3 (2-2)**
A study of the factors basic to the understanding of the soils of North Carolina, their classification, and properties as related to sound land use and management. Prerequisite:

Fundamentals of Soil Science 338.

AGEN-714. Applied Hydrogeology **Credit 3 (3-0)**

This course covers principles of groundwater resource evaluation and the approach or techniques used to solve groundwater problems. Discussion includes methods used to quantitatively appraise hydrogeologic parameters affecting water-yielding capacity of wells and aquifers. Various types of aquifers will be discussed under the umbrella of confined and unconfined aquifers. Ground water quality, conservation and contamination will also be covered.

SLSC-715. Soil Mineralogy **Credit 3 (3-0)**

A study of soil minerals with regard to their composition, structure, classification, identification, origin, and significance. Special emphasis on primary weatherable silicates, layer silicates, and oxide minerals. Prerequisites: SLSC-634 and consent of the instructor.

SLSC-717. Methodology in Soil, Plant and Water Analysis **Credit 3 (0-6)**

A study of principles involved in the analysis of soils, plants and water. Emphasis on basic instrumental and chemical methods for interpretation of soil fertility and environment. Instruction in the use of special instruments.

EASC-718. Applied Environmental Microbiology **Credit 3 (2-2)**

Discussion of interactions between micro-organisms and their physical environment, and significance of micro-organisms in eutrophication, mining spoils, and waste treatments. Prerequisites: General Microbiology-221 and consent of the instructor.

NARS-720. Graduate Seminar in Natural Resources **Credit 1 (1-0)**

SLSC-727. Soil Fertility and Plant Nutrition **Credit 3 (3-0)**

Fundamental and theoretical aspects of soil fertility, productivity and plant nutrients. A discussion of important research data on soil fertility and plant nutrition. Prerequisites: SLSC-517 and consent of the instructor.

SLSC-734. Applied Environmental Chemistry **Credit 4 (3-2)**

This course is an in-depth discussion of soil chemical interaction in terms of ion exchange, solution equilibrium, solubility patterns and also electrochemistry; comprehensive coverage of the chemistry of contaminant interactions with soil, its retention, movement and the environmental impact; review of relevant advances in soil chemistry in the past and recent times. Prerequisite: SLSC-634 or equivalent.

NARS-777. Special Problems in Plant Science **Credit 3 (3-0)**

AGRI-799. Thesis Research in Agriculture and Environmental Science **Credit 1-6 1 (1-0) to 6 (6-0)**

AGRI-999. Continuation of Thesis **Credit 1 (1-0)**

Physics

Solomon Bililign Chairperson
101 Marteena Hall
(336) 334-7733

OBJECTIVES

The Department of Physics provides quality instruction, mentoring, and training in order to produce competitive graduates who are trained in the arts of critical thinking, analytical reasoning, independent learning, and problem solving.

The Department of Physics has 7 full-time faculty and 4 adjunct faculty that participate in four actively funded research areas. These include low- and medium-energy physics, experimental and theoretical chemical physics, physics education, the physics of materials and geosciences. To support these efforts, the department receives over \$600,000 per year in research funds. Each year, faculty and students publish over 15-refereed articles and make over 25 presentations at national and international conferences.

The department has strong and active collaborations with major research institutions such as Duke University, the University of North Carolina at Chapel Hill, Stanford University, and the University of Connecticut. Collaborations with national laboratories include the Joint Institute for Laboratory Astrophysics (JILA), Lawrence Berkeley National Laboratory (LBNL), Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), and Thomas Jefferson National Accelerator Facility (JLab). International collaborations include the University of Marseilles in France and the Addis Ababa University in Ethiopia.

RESEARCH PROGRAMS AND FACILITIES

There are five research groups in the department with adequate facilities.

- a. **Low and Medium Energy Physics:** Research carried out on campus and at Thomas Jefferson National Accelerator Facility, and Triangle Universities Nuclear Laboratory with support by a grant from the National Science Foundation. **(Danagoulian, Gasparian, Ahmidouch, Pedroni)**
- b. **Chemical Physics: Experimental and Theoretical:** Facilities include: Two 20 Hz ND: YAG Laser two Continuum ND 6000 dye lasers, a UVX: frequency doubling and tracking system. A Continuum Leopard pico second laser with second, third and fourth harmonic generating crystals. Reflectron Time of Flight Mass Spectrometer: with pulsed source and effusive source. **Other Accessories** include a 35 cm McPherson Monochromator, a SPEX Spectrometer, a Tektronix digital oscilloscope, Le Croy 4 channel, 3GHz with 20 GS/s sampling rate oscilloscope, Box Car averager and gated integrator system (Stanford System), Power Supply (Stanford), Temperature controllers (Omega Engineering), PMT, PMT cooled housing, and optical components:
In addition for theoretical and computational work facilities include: Eight paralleled dual- processor Apple Macintosh G5's ("Big-Mac"), several IBM and SUN servers. The National Science Foundation supports the research. **(Bililign, and Levy)**
- c. **Physics of Materials:** Research in low temperature and semiconductor physics. **(Kebede, James)**
Facilities include: Closed cycle refrigerators, LR-400AC Resistance bridge, tube furnace, AC susceptibility set up, crystal growth setup, water cooled electromagnet (Varian), Lakeshore EM4-HV water cooled electromagnet
- d. **Physics Education:** Research on web-based education and innovative teaching methods and creating a responsive learning environment. The research is supported by a grant from The National Science Foundation and The Department of Education. **(James). Space and Earth Science Education** development through NASA grant **(Kebede)**
- e. **Seismic Data Processing Facility:** the research in seismic physical modeling, seismic data analysis, subsurface imaging and non-destructive testing using ultrasonic waves. The research is supported by a grant from the National Science Foundation. **(Burbach, Tang (Mathematics))**

The School of Graduate Studies through the Department of Physics offers two program tracks leading to the Master of Science in Physics: Professional Physics Applied Physics, and Computational Sciences with a Physics concentration.

The Professional Physics track provides the comprehensive preparation needed for the pursuit of a Ph.D. in physics or related areas. The Applied Physics track provides opportunity for interdisciplinary studies and research with other science, engineering, and mathematics programs to broaden the experience for employment in business, industry, or government. The MS in computational sciences is an interdisciplinary program, where students can work on a computational problem in physics after fulfilling the common requirements for the program.

DEGREES OFFERED

MS in Physics with concentrations in

Professional Physics
Applied Physics

GENERAL PROGRAM REQUIREMENTS

Admission to the M.S. in Physics degree program in the Department of Physics is based upon the general admission requirements of the University. In addition, regular admission to the M.S. in Physics degree program requires the undergraduate degree in physics or its equivalent. Regular admission also requires that an applicant's background reflect maturity in physics from junior and senior level undergraduate courses in classical mechanics, electromagnetism, thermodynamics and statistical mechanics, and quantum physics. Applicants may be admitted to graduate studies unconditionally, provisionally, or as special students. Provisional admission may be granted to those whose training is in other disciplines related to physics.

DEPARTMENT REQUIREMENTS

The M.S. in Physics degree program offers three options: the thesis option, the course work option and the project option. The thesis option requires a minimum of 30 semester hours, which includes 6 semester hours of thesis. The course work option requires a minimum of 33 semester hours plus a comprehensive examination. The project option requires a minimum of 30 semester hours plus 3 semester hours of special project. At least fifty percent of the courses counted towards the M.S. in Physics degree must be numbered 700 and above. In addition, the Professional Physics track requires a minimum of 24 semester hours of physics courses and the Applied Physics track requires a minimum of 18 semester hours of physics courses. The minimum physics course requirements include a core of competency courses in the following subjects: Classical Mechanics, Quantum Mechanics, Electromagnetic Theory, and Statistical Mechanics.

To meet graduation requirements, students must maintain and complete the M.S. in Physics program with an overall GPA of 3.0 or better on a scale of 4.0. Up to six semester hours of graduate work may be transferred from another university, provided it was not a part of any prior undergraduate degree requirement. The course content must adequately replace current graduate offerings in the student's curriculum. Transfer credits should be at a level comparable to 600 or 700 level courses at North Carolina A&T.

SUGGESTED CURRICULUM GUIDE

First Year

First Semester	Credit	Second Semester	Credit
PHYS 600 Classical Mechanics	3	PHYS 630 Statistical Mechanics	3
PHYS 615 Electromagnetic Theory I	3	PHYS 715 Electromagnetic Theory II	3
PHYS 620 Quantum Mechanics I	3	PHYS 720 Quantum Mechanics II	3

Second Year					
First Semester		Credit	Second Semester		Credit
PHYS 7XX	Elective		PHYS 7XX	Elective	
or					
7XX	Technical Elective	3	7XX	Technical Elective	3
PHYS 770	Research*		PHYS 770	Research*	
or					
PHYS 760	Special Topics*		PHYS760	Special Topics*	
or					
PHYS 740	Seminar*	0-3	PHYS 740	Seminar*	0-3
PHYS 791	Masters Project	3	PHYS 791	Masters Project	3
or					
PHYS 792	Masters Thesis	0-6	PHYS 792	Masters Thesis	0-6

* Graduate courses in Research, Special Topics, or Seminar may be substituted from other technical areas upon appropriate approvals.

List of Courses

Course	Description	Credit
PHYS 600*	Classical Mechanics	3 (3-0)
PHYS 601.	Selected Topics in Geophysics	3 (2-2)
PHYS. 602.	Introduction to Geophysical Research	3 (1-4)
PHYS 605	Mathematical Methods	3 (3-0)
PHYS 615*	Electromagnetic Theory I	3 (3-0)
PHYS 620*	Quantum Mechanics I	3 (3-0)
PHYS 630*	Statistical Mechanics	3 (3-0)
PHYS 715*	Electromagnetic Theory II	3 (3-0)
PHYS 720*	Quantum Mechanics II	3 (3-0)
PHYS 730	Optical Properties of Matter	3 (3-0)
PHYS 735	Atomic & Molecular Physics	3 (3-0)
PHYS 736	Spectroscopic Techniques	3 (3-0)
PHYS 737	Physics of Solids	3 (3-0)
PHYS 738	Nuclear Physics	3 (3-0)
PHYS 739	High Energy Physics	3 (3-0)
PHYS 740	Graduate Seminar	Var. 1-3
PHYS 743	Experimental Methods in Physics	3 (2-3)
PHYS 744	Introduction to Computational Methods in the Physical & Biological Sciences	3(3-0)
PHYS 745	Computational Physics	3 (2-3)
PHYS 750	Relativistic Quantum Mechanics I	3 (3-0)
PHYS 751	Relativistic Quantum Mechanics II	3 (3-0)
PHYS 760	Special Topics	Var. 1-3
PHYS 770	Research	Var. 1-9
PHYS 791	Masters Project	Var. 1-6
PHYS 792	Masters Thesis	Var. 1-6

*Required Core Courses

Courses for Professional Teachers

Course	Description	Credit
PHYS 705	Physics for Science Teachers I	Var. 1-6
PHYS 706	Physics for Science Teachers II	Var. 1-6
PHYS 707	Physics for Science Teachers III	Var. 1-6
PHYS 708	Physics for Science Teachers IV	Var. 1-6
PHYS 709	Physics for Science Teachers V	Var. 1-6

COURSES WITH DESCRIPTION IN PHYSICS
Advanced Undergraduate and Graduate

PHYS-600. Classical Mechanics

Credit 3 (3-0)

A theoretical treatment of particle and rigid body dynamics. Topics include variational principles, Lagrangian and Hamiltonian mechanics, the physics of rotation, oscillations, canonical transformations and Hamilton's equations, and Hamilton-Jacobi theory. Prerequisite: Physics-401 or Graduate standing.

PHYS 601 Special Topics in Geophysics

Credit 3 (2-2)

This is an advanced undergraduate and graduate course on selected topics in applied and computational geophysics. A descriptive title and syllabus must have received departmental approval before scheduling. Students' records will carry both course number and descriptive title. The course may be repeated to earn a maximum of six credit hours. Prerequisite: PHYS 241 or permission of instructor. (F;S)

PHYS 602 Introduction to Geophysical Research

Credit 3 (1-4)

This course involves student participation in research training in geophysical sciences conducted by faculty. It offers structured education and research training activities that guide experiences in geophysical topics, techniques and research projects involving geophysical surveys, physical modeling and numerical simulation. The course may be repeated to earn a maximum of six credit hours. The course is conducted in a lecture-laboratory format with one hour of lecture and four hours of laboratory per week. Prerequisite: PHYS 601 or permission of instructor. (F;S;SS)

PHYS-605. Mathematical Methods

Credit 3 (3-0)

Covers topics in mathematical physics: vector calculus, complex variables, Fourier theory, special functions and boundary value problems, variational methods, Green functions. Prerequisite: Graduate standing or consent of instructor.

PHYS-615. Electromagnetic Theory I

Credit 3 (3-0)

Along with Physics 715, is an advanced study of electromagnetic phenomena: electromagnetic properties of matter; propagation, radiation, and absorption of electromagnetic waves; simple radiating systems; special relativity, covariant electrodynamics; radiation by moving charges. Prerequisite: Physics-416 or Graduate standing.

PHYS-620. Quantum Mechanics I

Credit 3 (3-0)

An advanced study of quantum theory which along with Physics 720 covers the fundamental concepts and formulations: theory of measurement with applications to simple physical systems, operator formalism, symmetries and invariance, system of identical particles, angular momentum and the theory of spin, variational and perturbation approximation techniques, time-dependent perturbation theory and radiation, scattering theory with applications. Prerequisite: Physics-422 or Graduate standing.

PHYS-630. Statistical Mechanics

Credit 3 (3-0)

Fundamentals of classical and quantum statistical mechanics: statistical ensembles and distribution functions, non-interacting particles, ideal Fermi and Bose systems, treatment of interacting systems, phase transitions, approaches to collective phenomena. Prerequisite: Physics-430 or Graduate standing.

GRADUATE STUDENTS ONLY

PHYS-715. Electromagnetic Theory II

Credit 3 (3-0)

A continuation of Physics-615. Prerequisite: Physics-615.

PHYS-720. Quantum Mechanics II

Credit 3 (3-0)

A continuation of Physics-620. Prerequisite: Physics-620.

PHYS-730. Optical Properties of Matter

Credit 3 (3-0)

Classical wave properties of light and quantum mechanical treatment of the interaction of light and matter: interference, diffraction, absorption, scattering, and polarization of light, interaction with atoms, atomic structure, optical absorption and emission, laser theory. Prerequisite:

Graduate standing or consent of the instructor.

PHYS-735. Atomic and Molecular Physics

Credit 3 (3-0)

An advanced study of atomic and molecular systems. Topics include many-electron atoms, Hartree-Fock and self-consistent field methods, interaction of many-electron atoms with electromagnetic fields; diatomic molecules, Born-Oppenheimer approximation, rotation and vibration and electron spectra of diatomic molecules, polyatomic systems, laser spectroscopy, and molecular dynamics. Prerequisite: Physics-465 or Graduate standing.

PHYS-736. Spectroscopic Techniques

Credit 3 (3-0)

This course describes the methods and instrumentation of several spectroscopic techniques such as laser spectroscopy, optical resonance spectroscopy, supersonically cooled molecular spectroscopy, multiple photon spectroscopy, photoelectron spectroscopy, Raman scattering, Mössbauer spectroscopy, nuclear magnetic resonance spectroscopy, electron spin resonance spectroscopy, and mass spectroscopy. Prerequisites: Physics-465, 420 or Graduate standing

PHYS-737. Physics of Solids

Credit 3 (3-0)

An advanced study of the physics of solids with applications to metals semiconductors, and insulators. Topics include electronic structures, dynamics of electrons in solids, transport properties, optical properties, magnetic properties, and superconductivity. Prerequisite: Graduate standing or consent of the instructor.

PHYS-738. Nuclear Physics

Credit 3 (3-0)

Descriptions of properties of the nuclear force and nuclear structure: nucleon-nucleon scattering, nuclear scattering theory, phenomenological potential models, the shell model, collective motion, giant resonances, direct and compound reactions, few-body systems, heavy ion physics. Prerequisite: Graduate standing or consent of the instructor.

PHYS-739. High Energy Physics

Credit 3 (3-0)

Theoretical and experimental concepts in high energy physics. Topics include elementary particles; conservation laws; strong, weak, and electromagnetic interactions; particle accelerators; beams and detectors; strange particles; and quark models. Prerequisite: Physics-738 or Graduate standing.

PHYS-740. Graduate Seminar Variable

Credit (1-3)

A survey of current developments in physics.

PHYS-743. Experimental Methods

Credit 3 (2-3)

Theory and techniques of measurement in experimental physics: experimental design, detector development, signal processing techniques, data acquisition, error analysis, statistics and the treatment of experimental data. Prerequisite: Graduate standing or consent of the instructor.

PHYS 744 Introduction to Computational Methods in the Physical & Biological Sciences

Credit 3(3-0)

This course will offer an introduction to computational methods used in physics, chemistry and biology. It will survey the various methods used in those areas and give hands-on experience with some software. This may include, but not limited to: quantum chemistry calculations, electronic structure, empirical force fields and molecular mechanics, energy minimization, Monte Carlo and molecular dynamics simulations, structure of proteins, RNA/DNA sequence search and pattern recognition.

PHYS-745. Computational Physics

Credit 3 (2-3)

Computational approaches to advanced physical problems. Includes ordinary differential equations, boundary value and eigenvalue problems, matrix operations, Monte Carlo Methods, nonlinear equations, curve fitting, and approximation of functions. Prerequisite: Graduate standing or consent of instructor.

PHYS-750. Relativistic Quantum Mechanics I

Credit 3 (3-0)

Along with Physics-751 covers the Dirac equation and elementary mass renormalization, propagator theory, second quantization, the quantization of the electromagnetic field, Feynman

graphs, calculations in quantum electrodynamics and quantum chromodynamics, gauge theories, models of electromagnetic, weak and strong interactions. Prerequisite: Physics-720 or Graduate standing.

PHYS-751. Relativistic Quantum Mechanics II **Credit 3 (3-0)**
A continuation of Physics-750. Prerequisite: Physics-750.

PHYS-760. Special Topics Variable **Credit (1-3)**
Studies in physics under faculty guidance. Prerequisite: Graduate standing.

PHYS-770. Research Variable **Credit (1-9)**
This course is a supervised research under the mentorship of a faculty mentor. It is not necessarily intended to serve as the project or thesis topic of a master's student.

PHYS-791. Masters Project **Credit (3-0)**
The student will conduct a research project under the supervision of an advisor. The project could be experimental, theoretical, or a literature survey on a topic of interest to the student. This course is available to project option students. Prerequisite: Consent of advisor and masters standing.

PHYS-792. Masters Thesis Variable **Credit (1-6)**
The Master of Science thesis research will be conducted under the supervision of a thesis advisor to the completion of a masters thesis. The course is available to thesis option students. Consent of advisor and masters standing.

PROFESSIONAL TEACHERS PROGRAM

PHYS-705. Physics for Science Teachers I Variable **Credit (1-6)**
For in-service teachers. Course covers fundamentals of astronomy and earth science. Full descriptive title, syllabus and the amount of credit will have received departmental approval before scheduling. Prerequisite: MATH-111 or equivalent.

PHYS-706. Physics for Science Teachers II Variable **Credit (1-6)**
For in-service teachers. Lecture and integrated lab study of the fundamental principles of mechanics, thermodynamics, wave motion, electricity and magnetism, optics and modern physics. Full descriptive title, syllabus and the amount of credit will have received departmental approval before scheduling. Focus: Mechanics and Thermodynamics. Prerequisite: MATH-111 or equivalent.

PHYS-707. Physics for Science Teachers III Variable **Credit (1-6)**
A continuation of PHYS-706. Focus: Wave motion and electricity and magnetism. Prerequisite: PHYS-706 or equivalent.

PHYS-708. Physics for Science Teachers IV Variable **Credit (1-6)**
A continuation of PHYS-707. Focus: Optics and modern physics. Prerequisite: PHYS-707 or equivalent.

PHYS-709. Physics for Science Teachers V Variable **Credit (1-6)**
A continuation of PHYS-708. Focus: Modern Physics. Prerequisite: PHYS-708 or equivalent.

Social Work

Joint Master of Social Work Program*
Department of Sociology & Social Work
Dr. Arnold Barnes (NC A&T SU), Interim Co- Director - 336-334-7894
Dr. John Rife (UNCG), Co- Director - 336-334-4098

The Joint Master of Social Work (JMSW) program represents the efforts of faculty and administrators at North Carolina Agricultural and Technical State University (NC A&T SU) and the University of North Carolina at Greensboro (UNCG). The administration of the JMSW program rotates between the two campuses every four years.

This is a single academic program with instruction by faculty from each department. Students attend classes on the campuses of both universities and have access to all academic and support services of the two universities.

There are two portals of entry, each requiring 60 semester hours. The two portals are:

1. The full-time program which is completed in two years, and
2. The three-year part-time program with classes offered on Saturdays.

The Joint Master of Social Work Program is accredited by the Council on Social Work Education.

The JMSW curriculum has been designed by the joint faculty from both institutions to provide students with *advanced generalist* social work education. The model for the curriculum is based on contemporary, state-of-the-art theory and practice methods. Courses reflect the theme of providing effective services to families in urban and rural North Carolina communities. The curriculum is organized by foundation, area of practice, advanced generalist integrative seminars, and field instruction. The primary purpose of the MSW program is to prepare students for advanced generalist social work practice.

* Jointly administered with UNCG

Program goals are:

- Goal 1: To prepare graduate students for employment as advanced generalist social work practitioners in direct and indirect practice.
- Goal 2: To provide students with a graduate advanced generalist social work curriculum that results in the acquisition and demonstration of:
- A. Knowledge of human behavior and the social environment, social welfare policy, research, practice methods, cultural diversity populations at-risk, social and economic justice, and social work values and ethics as a foundation for generalist social work practice
 - B. The professional self as reflected in an affiliation with the profession of social work
 - C. The values and ethics of professional social work practice as stated by the National Association of Social Worker's Code of Ethics
 - D. Advanced generalist social work practice skills with individuals, families, groups, organizations, and communities.
- Goal 3: To provide professional service that ameliorates social problems, provides leadership, and benefits our communities in Central and Western North Carolina.
- Goal 4: To conduct and disseminate research that contributes to the knowledge base for effective social work practice.

CURRICULUM PLAN

The curriculum design of the program provides students with a theoretical and applied education in social work to enhance and promote advanced generalist social work education. The two-year program is organized to insure that all students, as advanced social work practitioners, will be prepared to independently engage in social work practice with individuals, families, small groups, organizations, and communities in their chosen area of practice. Students will be prepared to serve as managers, supervisors, researchers and social planners. The concentration of the program is advanced generalist practice.

COURSE OF STUDY AND DEGREE REQUIREMENTS

The MSW program is a two-year program of 60 credits that will require full time enrollment by students. The program offers a foundation year and a second year of concentration content for advanced practice.

First Year Foundation Courses (30 Hours)

NCA&TSU UNC-G

First Semester 15 Credit Hours

SOWK 700	Human Behavior and Social Functioning I	3	SOWK 501
SOWK 701	Social Welfare Policy and Analysis I	3	SOWK 502
SOWK 703	Social Work Practice with Individuals and Families	3	SOWK 504
SOWK 704	Interpersonal Skills Lab (Social Work with Groups)	3	SOWK 560
SOWK 705	Social Work Practice and Human Diversity	<u>3</u>	SOWK 511
		15	

Second Semester 15 Credit Hours

SOWK 702	Human Behavior and Social Functioning II	3	SOWK 517
SOWK 707	Social Work Research Methods I	3	SOWK 503
SOWK 708	Social Work Practice with Communities and Organizations I	3	SOWK 514
SOWK 709	Field Instruction and Seminar I	<u>6</u>	SOWK 516
		15	

Second Year- Advanced Curriculum (30 Hours)

First Semester Area of Practice Course Credit

SOWK 706	Social Policy and Welfare Analysis II	3	SOWK 512
SOWK 710	Social Work with Families and Youth at Risk	3	SOWK 601
SOWK 712	Social Work in Health Care I		SOWK 602
SOWK 714	Social Work in Mental Health I		SOWK 603
SOWK 718	Research Designs & Data Analysis for Social Work Practice	3	SOWK 513
SOWK 722	Field Instruction and Seminar II	<u>6</u>	
		15	

Second Semester Area of Practice Course Credit

SOWK 711	Social Work with Families and Youth at Risk II	3	SOWK 611
SOWK 713	Social Work in Health Care II		SOWK 612
SOWK 715	Social Work in Mental Health II		SOWK 613
SOWK 716	Social Work in Administration	3	SOWK 605
	Elective	3	
SOWK 724	Field Instruction and Seminar III	<u>6</u>	SOWK 616
		15	
Total Hours		60	

FOUNDATION YEAR

During the first year, students complete 30 semester hours of foundation course work. In the first semester of the first year, students complete courses in human behavior and social functioning, social welfare policy, social work practice and human diversity, social work practice with individuals and families, and social work practice with groups. In the second semester of the first year, students complete a second human behavior and social functioning course, social work practice with communities and organizations, social work research methods, and a six semester hour foundation field instruction placement and seminar. The purpose of the foundation course work during the first year is to prepare students for the advanced generalist practice year.

ADVANCED GENERALIST PRACTICE YEAR

In the second year of study, students complete the concentration in advanced generalist practice. The second year of study requires the completion of 30 semester hours of course work. Students choose one of three advanced generalist practice areas: families and youth at risk,

mental health, or health. Students complete two courses in their advanced generalist practice area, advanced courses in social welfare, administration, and research, and they complete two semesters of advanced generalist field instruction, which includes a field seminar and a capstone project. Students also complete one graduate level elective. Choice of this elective requires the approval of the student's educational advisor.

ADMISSIONS

A Joint Admissions Committee has been established for this program. It is comprised of faculty members from NCA&TSU and faculty members from UNCG. These committee members use a common evaluation system to review applications and recommend applicants for admission.

In addition to the admission materials set forth by The Graduate School, applicants must complete the following prerequisites to become eligible for admissions review:

1. Completion of a baccalaureate degree, with competitive grades, from an accredited college or university in the United States or its equivalent in another country;
2. A "B" average or better in the undergraduate major;
3. An overall minimum GPA of 2.5 and an acceptable score on the GRE;
4. Evidence of a liberal arts foundation to include the following minimum 30 credit hours:
 - 18 Social and Behavioral Sciences*
 - 6 Humanities
 - 3 Human Biology
 - 3 Statistics
 - 30 Hours

* (Political Science, Psychology, Anthropology, Economics, Ethnic/Global Studies, History, and Sociology).

5. Applicants must demonstrate intellectual and personal qualifications considered essential to the successful practice of social work, such as sensitivity and responsiveness in relationships, concern for the need of others, adaptability, good judgment, creativity, integrity, and skill in oral and written communication. This determination shall be based on a review of the applicant's references and written personal statement.

Documentation validating that applicants meet the above criteria will be required in the admission packet. Members of the Joint Admissions Committee and staff at the two graduate schools will verify that acceptable validation of these five criteria have been included in applicants admission materials.

The Joint Admissions Committee has established five areas that will be rated to determine admission decisions:

1. Acceptable GRE scores;
2. GPA averaged from all undergraduate and graduate degrees;
3. Three letters of recommendation;
4. Relevant paid and/or volunteer experience (including internships in social work);
and,
5. A personal statement indicating why applicant is seeking admission, what applicant wants to learn and the factors that influenced this decision.

Consistent rating measures have been established for the evaluation of the five above areas. The Joint Admissions Committee has developed a review process that ensures a consistent and fair evaluation of applicants. All applicants will be notified in writing of the Joint Admissions Committee decisions by The Graduate School.

The M.S.W. Program does not grant academic credit for life or work experience. Only students who have been admitted to the program and who have completed all required prerequisite course work may be admitted to practice courses and to the field instruction program.

The program admits students only once a year for Fall semester enrollment. Questions concerning the MSW program may be addressed to the Department of Sociology & Social Work, NCA&TSU. The phone number is (336) 334-7894. All inquiries concerning admission for Fall 2002 should be directed to: The Graduate School, University of North Carolina at Greensboro, PO Box 26176, Greensboro, NC 27402-6176. The phone number is (336) 334-5596.

Applications for admission of Fall 2003 – 2006 will be processed through the School of Graduate Studies, North Carolina A&T State University, 1601 East Market Street, 120 Gibbs Hall, Greensboro, NC 27411. The phone number is (336) 334-7920.

COURSE DESCRIPTIONS IN SOCIALWORK

SOWK-700. Human Behavior and Social Functioning I **Credit 3 (3-0)**

This course is the first of a two course sequence on human behavior in the social environment. This course emphasizes theories of human behavior and intervention with people in a variety of systems, including individuals, families, and small groups. Students will learn an ecological framework for understanding and assessing human behavior in social and cultural contexts. Content about various oppressed and vulnerable groups is included. Culture is examined to analyze how it affects clients and workers perceptions of problems, their conceptualizations of strategies for problem-solving, their orientations in measuring treatment outcomes, and the efficacy of the worker-client relationship.

SOWK-701. Social Welfare Policy and Analysis I **Credit 3 (3-0)**

This first foundation policy course is designed to help the student examine philosophical, social, political, psychological, and economic factors that have influenced the emergence of social welfare as a social institution. Students learn to analyze social policy for its effects on individuals, families, various oppressed and vulnerable groups, and communities. The impact of social policy on service delivery in rural areas will be highlighted. This is the first of two policy courses.

SOWK-702. Human Behavior and Social Functioning II **Credit 3 (3-0)**

Human Behavior and Social Functioning II provides students with the knowledge necessary to analyze institutional, social and cultural environments in which human behavior occurs, and the reciprocal interaction between individuals, communities, organizations, groups and families. The course provides students with the concepts and knowledge necessary to understand adult development and the development of families and groups in community. HBSF II builds on personality and developmental theory that was introduced in HBSF I to emphasize the biopsychosocial-spiritual nature of human beings in their family environment. This course presents groups and families as social entities that affect and are affected by individual social functioning and behaviors.

SOWK-704. Interpersonal Skills Lab (Social Work with Groups) **Credit 3 (3-0)**

The purpose of the Interpersonal Skills Lab is to prepare students for entry into field instruction. The course allows students the opportunity to examine and practice interpersonal communication skills in preparation for professional practice. This course introduces students to a number of skills considered basic to social service delivery. Experiential learning is stressed, and ample opportunity will be provided for students to practice basic interpersonal skills and receive feedback on their performance. This course is taken concurrently with Social Work Practice with Individuals and Families.

SOWK-705. Social Work Practice and Human Diversity I **Credit 3 (3-0)**

This course will examine cultural and social diversity and address theoretical and practice dimensions of social practice with oppressed people of color, women, the aged, the sexually diverse, and the physically disabled. The concepts of ethnicity, minority status, social stratification, and sexual preference are explored in the context of American culture and are translated into the impact of dealing with these issues with clients, the system, and with the helper.

SOWK-706. Social Welfare Policy and Analysis II **Credit 3 (3-0)**

This course, the second foundation course in social welfare policy, presents social welfare policy analysis as another form of social work practice, with a repertoire of roles, functions, and skills as in other practice concentrations such as interpersonal or planning and management. As a part of this school's professional curriculum, the course will embody the primary value of social justice as it examines policies, programs and current delivery systems in addressing issues affecting families, mental and health care. Strategies to shape and frame policy at various levels are addressed.

SOWK-707. Social Work Research Methods I**Credit 3 (3-0)**

This course is the first of two research courses in the MSW curriculum. The intention of both courses is to prepare the social work practitioner to use research as a means of informing and improving one's professional practice. The primary purpose of this course is to provide a framework for the rigorous study of research methodology as it relates to the professional practice of social work. As a result of this course, students will learn, appreciate, and be able to apply quantitative and qualitative research strategies to address fundamental social work problems and processes.

SOWK-708. Social Work Practice with Communities, and Organizations**Credit 3 (3-0)**

This course is designed to prepare students to practice in the area of macro social work. Advanced generalist social workers must be prepared to respond to and influence changing social and political environments. This course prepares students for involvement in broad scale social systems change particularly in group, community, and organizational development and analysis. This course provides a framework for exploring knowledge, analytical skills, and professional behavior appropriate for practice with work groups, communities, and organizations. Particular emphasis will be given to the multidimensional strategies for professional intervention.

SOWK-709. Field Instruction and Seminar I**Credit 6 (6-0)**

This is the first year of the field curriculum. The purpose of the two courses is to provide an opportunity to students to synthesize theoretical knowledge for application within a variety of agency settings and among diverse client systems. Students are expected to apply theories and concepts from previous courses in the role of a professional social work practitioner within the client system of various field agency experiences. Field seminar will run concurrently with the field practicum. Student field days are typically Wednesday, Thursday and Friday for a total of 24 clock hours per week.

SOWK-710. Social Work with Families I**Credit 3 (3-0)**

This is the first course in the concentration on Social Work with Families and Youth at Risk. This course will integrate elements of social policy that affect families with the theory, knowledge, and skills necessary to work with diverse family forms at different stages of life. Building on foundation year content regarding the families, this course will prepare students to assess and intervene with families at an advanced level. An ecological systems perspective will be utilized to help students understand the relationships between individuals and their families and between families and the various social systems with which they interact.

SOWK-711. Social Work with Families II**Credit 3 (3-0)**

This is the second course in the concentration sequence on Social Work with Families and Youth at Risk. This course will build on the advanced knowledge and skill gained in the previous course and allows students to apply that knowledge to specific problems faced by families across the life span. By participating in this problem-focused course, students will have an opportunity to learn more about the types of problems families face in the United States and how to use various interventive models most appropriate to specific types of problems.

SOWK-712. Social Work in Health Care I**Credit 3 (3-0)**

This is the first of two courses in social work practice within the health care delivery system. Students utilize a functional health and systems model to analyze biomedical and psychosocial aspects of coping with health and illness. Students explore the complex interrelationships between health care practices, social work values, and ethical dilemmas presented by conflicting ideologies and advancing technology. Students will integrate knowledge and skills to deliver social work intervention in various health settings including hospitals, hospice, geriatrics, home health care, public health, and community health education.

SOWK-713. Social Work in Health Care II**Credit 3 (3-0)**

This course further explores various practice models for working within different health and aging settings. Students explore direct and indirect skills needed to function in a variety of settings including hospitals, hospices, geriatrics, home health and health education initiatives. Special attention is given to assessing and understanding differential patterns of health care

service utilization and delivery based on demographic characteristics such as age, race, ethnicity, gender, sexual orientation, and residence. Students will gain knowledge and skills in health and geriatric social work practice to work with individuals, families, and small groups.

SOWK-714. Social Work in Mental Health I **Credit 3 (3-0)**

This course, the first of two concentration courses in social work practice in mental health, is designed to expose students to major policy issues, practice theory, and direct service roles in both inpatient and outpatient mental health settings. Students will gain knowledge of the history of mental practice in the United States, major advances in psychiatric care from biological, social, and interpersonal perspectives, and current practice approaches with vulnerable populations.

SOWK-715. Social Work in Mental Health II **Credit 3 (3-0)**

This course, the second of two concentration courses in social work practice in mental health, is designed to expose students to specific clinical approaches to the practice of social work in mental health settings. Using a seminar format and a case study approach, students will expand their knowledge and skills from the first concentration course in treating specific mental disorders. Students examine the context of mental health practice including the impact of policy and organizations upon practice as well as the strengths and constraints of multidisciplinary treatment approaches.

SOWK-716. Social Work in Administration **Credit 3 (3-0)**

As advanced generalist practitioners, students must be prepared for indirect as well as direct practice roles. The purpose of this course is to provide students with the basic knowledge and skills necessary to function as a social work supervisor and manager. Students from the three concentrations will take this course together, thus allowing all students to gain a broader understanding of social work administrative issues in various fields of practice. This course will highlight specific issues relevant to social work management in both urban and under-served rural areas.

SOWK-718. Research Designs and Data Analysis for Social Work Practice **Credit 3 (3-0)**

This course is the second of two research courses in the MSW curriculum. The intention of both courses is to prepare the social work practitioner to use research as a means of informing and improving one's professional practice. Students will be able to apply quantitative and qualitative research strategies to address fundamental social work problems and processes
Elective Credit 3 (3-0)

SOWK-722. and SOWK-724. Field Instruction and Seminar II and III **Credit 6 (6-0)**

Second year field is a culmination of the academic preparation for Social Work practice. As advanced Generalists, students are expected to demonstrate understanding and application of social work theories, skills and interventions. Additionally, students are expected to assume greater independence in their own practice. Field Seminar will run concurrently with the field practicum. Student field days will typically be Wednesdays, Thursdays and Fridays of each week, August- May. Specialized placements in School Social Work require a longer placement. School social work internships include activity three days a week for the academic year, August-June.

Department of Sociology and Social Work

Dr. Robert Davis, Interim Chairperson
201 Gibbs Hall

Note: The courses listed below are offered to advanced undergraduate and graduate students only. Please note that these courses are not part of the Joint Master of Social Work (JMSW) curriculum.

Courses Offered for Advanced Undergraduate and Graduate Students

SOCI-600	Seminar in Social Planning
SOCI-601	Seminar in Urban Studies
SOCI-603	Introduction to Folklore
SOCI-625	Sociology/Social Service Internship
SOCI-650	Independent Study in Anthropology

SOCI-651	Anthropological Experience
SOCI-669	Small Groups
SOCI-670	Law and Society
SOCI-671	Research Methods II
SOCI-672	Selected Issues in Sociology
SOCI-673	Population Studies
SOCI-674	Evaluation of Social Programs
SOCI-701	Seminar in Cultural Factors in Communication

Transportation and Logistics

Basil G. Coley, Interim Chairperson
Room 312E, General Classroom Building
(336) 334-7744

OBJECTIVE

The Department of Economics and Transportation/Logistics offers a program of study leading to the Master of Science in Management degree with a major concentration in Transportation and Logistics. The program prepares students and professionals for careers in public and private sector positions in transportation and business logistics. The program blends traditional management education in the areas of marketing, management, and quantitative analysis, with specialized core competencies relating to transportation planning, transportation and business logistics, supply chain and materials management, and purchasing.

DEGREE OFFERED

Master of Science in Management – Transportation and Logistics

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.6 (on a 4.0 scale), and a satisfactory GMAT score. Applicants who do not meet the requirements will be considered on an individual basis. A GPA of 3.0 is required for graduation.

PROGRAM REQUIREMENTS

Students with a variety of undergraduate majors are encouraged to apply. The program is designed to appeal to those who either currently work in industry or desire to affiliate with firms or organizations using cutting-edge tools to deliver their products or services. Students in the program will have a business undergraduate degree and wish to study a particular area in greater depth, or have a non-business degree with the personal or professional interests or experiences that would be enhanced by a high quality graduate program in management education.

The program requires a minimum of 36 semester hours. There is no thesis requirement. Students without an undergraduate business degree will be required to take appropriate foundation courses, which may extend the requirements to 48 semester hours. The program consists of 21 hours of core courses, including one 3-hour elective, and 15 hours of coursework in the major concentration.

The student pursuing the Master of Science in Management with a major concentration in Transportation/Logistics is required to complete a common core of courses consisting of:

ACCT 714 Managerial Accounting & Finance	3 semester hours
BUAD 713 Business Applications Development	3 semester hours
BUAD 715 Quantitative Business Analysis	3 semester hours
BUAD 716 Strategic Marketing	3 semester hours
BUAD 718 Management & Organization Analysis	3 semester hours
ECON 608 Managerial Economics	3 semester hours

ELECTIVE *One course selected from the following:*

ACCT 643 Advanced Income Tax Accounting	3 semester hours
BUAD 719 Information Systems Planning and Design	3 semester hours

Courses in the Transportation and Logistics concentration will consist of the following:

TRAN 701 Strategic Logistics Management	3 semester hours
TRAN 720 Analysis and Design of Supply Chain Systems	3 semester hours
TRAN 725 Purchasing and Materials Management	3 semester hours
TRAN 727 Global Supply Chain Management	3 semester hours
TRAN 730 Transportation Planning	3 semester hours

Students without an undergraduate business-related degree will be required to take appropriate foundation courses, which consist of the following.

ACCT 708 Seminar in Financial Concepts	3 semester hours
BUAD 705 Seminar in Business Analysis	3 semester hours
BUAD 712 Foundation of Enterprise Management	3 semester hours
ECON 706 Seminar in Economics	3 semester hours

LIST OF GRADUATE COURSES

Course Description	Credit
ACCT 643 Advanced Income Tax Accounting	3
ACCT 708 Seminar in Financial Concepts	3
ACCT 714 Managerial Accounting & Finance	3
BUAD 705 Seminar in Business Analysis	3
BUAD 712 Foundation of Enterprise Management	3
BUAD 713 Business Applications Development	3
BUAD 715 Quantitative Business Analysis	3
BUAD 716 Strategic Marketing	3
BUAD 718 Management & Organization Analysis	3
BUAD 719 Information Systems Planning and Design	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3
TRAN 701 Strategic Logistics Management	3
TRAN 720 Analysis and Design of Supply Chain Management	3
TRAN 725 Purchasing and Materials Management	3
TRAN 727 Global Supply Chain Management	3
TRAN 730 Transportation Planning	3

COURSES WITH DESCRIPTION IN ECONOMICS AND TRANSPORTATION AND LOGISTICS

BUAD 713. Business Applications Development **Credit 3 (3-0)**

This course focuses on application development and tools for business solutions. Concepts associated with the design, creation, and implementation of computer programs are studied. Application algorithms are designed using supportive software tools such as flowcharts, pseudocode, and hierarchy charts. Emphasis is placed on the development of applications using systems methods, top-down design, testing, debugging, modularity, and structured techniques to be implemented and maintained in a variety of business environments. This course uses an object-oriented programming language.

BUAD 719. Information Systems Planning and Design **Credit 3 (3-0)**

This course provides students with an understanding of the concepts of planning, analysis, design, and implementation of modern information systems. Techniques used in this course are project tracking, structured analysis and design, prototyping, and techniques for incorporating human factors considerations. These project planning and design issues will be discussed both in terms of the traditional systems development life cycle and in terms of business process reengineering. Students will use both Computer Aided Software Engineering (CASE) tools, Business Process Reengineering (BPR) and Project Tracking (GANTT network diagrams, task tracking) tools in their project work.

ECON-608. Managerial Economics **Credit 3 (3-0)**

This course will apply economic principles to decision-making in management. The basic tools and methods of analysis are derived mainly from microeconomics. Additional tools discussed include statistical methods, operations research, financial analysis, and decision-making theory that are applied to managerial problems. Particular emphasis will be placed on demand analysis, forecasting, pricing and output decisions, cost-benefit analysis, present value analysis, costbenefit analysis, capital budgeting, risk analysis, and decision-making under uncertainty.

ECON-706. Seminar in Economics**Credit 3 (3-0)**

This course introduces basic microeconomic principles and their applications in business. Basic economic concepts, including marginal analysis of consumer and firm decisions, will be covered along with macroeconomic theories that support managers' understanding of the global economic environment and the economic policies affecting that environment.

TRAN-701. Strategic Logistics Management**Credit 3 (3-0)**

This course is designed to introduce students to the critical role of logistics in the achievement of strategic objectives. This approach involves all activities associated with moving raw materials, inventory, and finished goods from the point of origin to the point of use or consumption. The course addresses logistics strategy, planning, customer service goals, transportation fundamentals and decision-making, transportation strategy, inventory and location strategies, organization and control.

TRAN-720. Analysis and Design of Transportation and Logistics Systems**Credit 3(3-0)**

This logistics modeling course deals with various ways of modeling logistics forecasts to facilitate supply chain management, mode selection, distribution planning, facility location, network design and optimization, routing and scheduling. Software will be used extensively to model logistics and supply chain applications.

TRAN-725. Purchasing and Materials Management**Credit 3(3-0)**

This course focuses on purchasing as the integration of long-term materials planning with corporate strategic planning process. The increasingly strategic role played by the purchasing professional in an organization is also examined. Areas receiving special attention include collaborative participation in the identification and procurement of key material requirements, determination and application of supplier qualification and selection activities, implementation of supplier development programs, relationship building programs, and participation in supply chain development decisions.

TRAN-727. Global Supply Chain Management**Credit 3(3-0)**

This course addresses issues in global supply chain management. Some topics addressed are international sourcing, evaluating international suppliers, outsourcing, financial management issues, relationship management, information management, and selecting international carriers. The course relies on cases to understand and solve problems in global supply chain management.

TRAN-730. Transportation Planning**Credit 3(3-0)**

This course addresses the transportation planning process and related activities. Topics of special focus are modal classifications, data requirements, transportation demand analysis, methods of evaluation (GIS, cost-benefit analysis, internal rate of return, payback period, etc). Others are multiple criteria evaluation method, post-project evaluation, finance, transportation demand management, and issues in intelligent transportation systems.

GRADUATE FACULTY

School of Agriculture and Environmental Sciences

Department: Agribusiness, Applied Economics, and Agriscience Education

Chair: Dr. Anthony K. Yeboah

Kofi Adu-Nyako, B.S., University of Science and Technology; M.S., Cornell University; Ph.D., University of Florida, Adjunct Associate Professor
Antoine J. Alston, B.S., M.S., North Carolina A&T State University; Ph.D., Iowa State University, Associate Professor
Marcus Comer, B.S., M.S., Tennessee State University, Ph.D., University of Missouri, Assistant Professor
Godfrey C. Ejimakor, B.S., North Carolina State University; M.S., North Carolina A&T State University; Ph.D., Texas Tech, Associate Professor
Benjamin Gray, B.S., M.S. North Carolina A&T State University, Ph.D., North Carolina State University, Adjunct Assistant Professor
Kenrett Y. Jefferson-Moore, B.S. Southern University, M.S. Alabama A&M University, Ph.D. Auburn University, Assistant Professor
Daniel M. Lyons, B.S., M.S., North Carolina A&T State University; Ed.D., Virginia Polytechnic Institute and State University, Agricultural Extension Faculty, Administration
Donald R. McDowell, B.S., Southern University A&M; M.S., Ph.D., University of Illinois, Professor/Associate Dean for Academic programs
John O'Sullivan, B.A., Stanford University; M.S., Auburn University; Ph.D., University of California at Los Angeles, Agricultural Extension Faculty
John P. Owens, B.S. Appalachian State University, M.S. North Carolina A&T State University, Adjunct Instructor
Richard D. Robbins, B.S., N. C. A&T State University; M.S., Ph.D., North Carolina State University, Professor
Terrence Thomas, B.S., University of West Indies; M.S., University of Wisconsin; Ph.D., Louisiana State University, Adjunct Associate Professor
Alton Thompson, B.S., North Carolina Central University; M.S., Ph.D., Ohio State University, Professor and Dean
Anthony K. Yeboah, B.S., University of Science and Technology, Kumasi, Ghana; M.S., Ph.D., Iowa State University, Professor and Chairperson
Osei-Agyeman Yeboah, B.S. University of Science and Technology, Kumasi, Ghana, M.S. North Carolina A&T State University, Ph.D. University of Nebraska, Adjunct Assistant Professor

FACULTY EMERITI

Sidney H. Evans, B.S. Virginia State University, M.A. Ph.D. Ohio State University, Professor Emeritus

Department: Animal Sciences

Interim Chair: Dr. David W. Libby

Allen, John W., B.S., University of Georgia; M.S., Ph.D., University of North Carolina; Adjunct Assistant Professor
Branch, Stacy, B.S., University of Pittsburgh; DVM, Tuskegee University; Visiting Scholar
Fultz, Doris G., B.S. (Biology), Virginia Commonwealth University; B.S., DVM, Tuskegee University; Associate Professor
Hanner, Tracy L., B.S., North Carolina Central University; DVM, North Carolina State University; Adjunct Assistant Professor
Libby, David W., B.S., M.S., Ph.D., University of Maine; Associate Professor
McKinnie, M. Ray, B.S., North Carolina A&T State University; M.S., Ohio State University; Ph.D., North Carolina State University; Associate Dean for Cooperative Extension Program
Willis, Willie, B.S., Fort Valley State University; M.S., Ph.D., Colorado State University; Professor
Worku, Mulumebet, B.Sc., Addis Ababa University, Alemaya College of Agriculture, Ethiopia; M.S., Ph.D., University of Maryland, College Park; Associate Professor

Department: Human Environment and Family Sciences

Chair: Dr. Gladys G. Shelton

Mohamed Ahmedna, B.S., Institute Agronomique et Veterinaire Hassan II; M.S., Ph.D., Louisiana State University Adjunct Assistant Professor

Mary J. Baldwin, B.S., M.Ed., Ph.D., University of North Carolina at Greensboro, Cooperative Extension Faculty

Thessaleneuve Hinnant-Bernard, B.S., M.S., North Carolina Central University, Ph.D., Iowa State University, Adjunct Assistant Professor

Thelma Feaster, B.S., North Carolina A&T State University; M.A., Case Western Reserve University, Ph.D., The Ohio State University, Cooperative Extension Faculty

Ipek Goktepe, B.S., University of Istanbul, M.S., Ph.D., Louisiana State University, Adjunct Assistant Professor

Thurman N. Guy, B.S., M.S., North Carolina A&T State University, Ed.D., University of North Dakota, Associate Professor

Salam A. Ibrahim, B.S., University of Mosul, M.S., University of Georgia, Ph.D., University of Kentucky, Adjunct Assistant Professor

Valerie J. McMillan, B.S., M.Ed, South Carolina State University; Ph.D. Iowa State University, Associate Professor

Rosa Siler Purcell, B.S., North Carolina A&T State University; M.Ed., Ph.D., University of Illinois, Associate Professor

Geraldine Ray, B.S., North Carolina A&T State University; M.Ed., University of North Carolina Greensboro, Ph.D., Virginia Polytechnic Institute and State University, Associate Professor

Shirley Rouse McNeill, B.S., North Carolina A&T State University; M.Ed., North Carolina State, Ph.D., University of North Carolina at Greensboro, Cooperative Extension Faculty

Lizette Sanchez-Lugo, B.S., University of Puerto Rico, M.P.H., University of Puerto Rico, M.S., Wake Forest University, Ph.D., University of North Carolina at Greensboro, Assistant Professor

Chung W. Seo, B.S., M.S., Korea University, Ph.D., Florida State University, Professor

Gladys G. Shelton, B.S., North Carolina Central University, M.S., Cornell University, Ph.D., Virginia Polytechnic Institute and State University, Associate Professor and Chairperson

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FACULTY EMERITI

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Department: Natural Resources and Environmental Design

Chair: Dr. G. B. Reddy

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 G. Yang, B.S., Jilin Agricultural University; M.S., Ph.D., University of Nebraska-Lincoln; Adjunct Associate Professor

College of Arts and Sciences

Department: Biology
Interim Chair: Dr. Mary Smith

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 Javier Cisneros, D.V.M., Universidad Central del Ecuador; M.S., North Carolina A&T State University; Ph.D., North Carolina State University; Assistant Professor
 Roy Coomans, B.S., Eckerd College; Ph.D., University of North Carolina-Chapel Hill; Associate Professor
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Department: Chemistry

Interim Chair: Dr. Claude N. Lamb

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Department: English

Interim Chair: Dr. Shirley H. Bell

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Garren, Samuel B. B.A., Davidson College; M.A., Ph.D., Louisiana State University; Professor
Greene, Michael. B.A., Duke University; M.A., Ph.D., Indiana University; Professor
Kamara, Gibreel M. B.A., M.A., North Carolina A&T State University; Ed.D., Temple University; Associate Professor
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Department: History

Chair: Dr. Olen Cole, Jr.

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 Conchita F. Kemei, B.F.A., Xavier University; M.A., Ph.D., Howard University; Professor
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Department: Mathematics
Chair: Dr. Wilbur Smith

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Nail K. Yamaleev, M.S., Ph.D., Moscow Institute of Physics and Technology; Associate Professor

Department: Physics

Chair: Dr. Solomon Bililign

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Caesar R. Jackson, B.E.T., Florida A&M University; M.S., University of Florida; Ph.D., N.C. State University; Professor and Interim Dean
Floyd J. James, B.S., M.S., University of North Carolina; Ph.D., University of N.C. at Chapel Hill; Associate Professor
Abebe B. Kebede, B.S., Addis Ababa University; M.A, Ph.D., Temple University; Associate Professor
Ronald S. Pedroni, B.A., Jacksonville University; Ph.D., Duke University; Associate Professor
Melvin Levy, Ph.D, Ph.D., Indiana University Research Professor

Department: Sociology & Social Work /Joint Master of Social Work

Interim Chair: Dr. Robert Davis

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Arnold Barnes, Ph.D., Washington University; M.S.W. University of Maryland at Baltimore; B.A., University of Maryland at Baltimore; Assistant Professor
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Phillip Carey, Ph.D., Oklahoma State University; M.S.C., Oklahoma State University; B.S.C., Oklahoma State University; Professor.
Robert Davis, B.A., Southern University; M.A., Atlanta University; Ph.D., Washington State University; Post-Doctoral, University of Wisconsin at Madison; Professor
David Johnson, B.A., Hamilton College; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill; Associate Professor
Sarah V. Kirk, B.A., St. Augustine's College; M.S.W., Atlanta University; M.P.H., University of Pittsburgh; Ph.D., University of Pittsburgh; Professor
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ADJUNCT GRADUATE FACULTY – UNCG

Jacalyn Claes, B.S., Western Illinois University; M.S., Western Illinois University; M.S.W., University of Iowa; Ph.D., University of Iowa; Associate Professor.
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Carolyn Moore, B.S., North Carolina A&T State University; M.S.S.A., Case Western Reserve

University; Lecturer
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School of Business and Economics

Department: Economics and Transportation/Logistics

Interim Chair: Dr. Basil G. Coley

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David Chen, B.S., National Taiwan University; M.S., New Mexico State University; Ph.D.,
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Professor
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Department: Business Administration

Interim Chair: Dr. Edna J. Ragins

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Professor
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Ph.D., The University of Memphis; Assistant Professor
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School of Education

Department: Curriculum and Instruction
Chair: Dr. Dorothy Leflore

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Department: Human Development and Services

Chair: Dr. Wyatt Kirk

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Department: Human Performance and Leisure Studies
Chair: Dr. Deborah Callaway

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College of Engineering

Program: Chemical Engineering
Director: Dr. Vinayak Kabadi

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Department: Civil, Architectural, Agricultural and Environmental Engineering

Chairperson: Dr. Peter Rojeski, Jr., P.E.

Program: Civil and Environmental Engineering Director: Dr. Emmanuel Nzewi, P.E.

Program: Bioenvironmental Engineering Director: Dr. Abolghasem Shahbazi

Program: Architectural Engineering Director: Dr. Peter Rojeski, Jr., P.E.

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HOUSING AND RESIDENCE LIFE

<http://www.ncat.edu/~housing/>

Administering to the physical environmental needs, along with the personal, educational and cultural development of over 4,200 residents, Housing and Residence Life support students' academic success. The Department strives to achieve this goal through the maintenance of comfortable, clean and safe living and learning environments, coupled with developing partnerships with other entities that attend to the critical thinking, problem-solving, and community and civic responsibility perspectives and understandings of students.

Office of Career Services

The mission of the Office of Career Services (OCS) of North Carolina Agricultural and Technical State University is to provide centralized, comprehensive and progressive programs, services, and resources in preparing students to achieve meaningful and successful career development. Continuous career development assistance is also available to alumni of the University.

Career Services is customer focused and centralizes the functions of off-campus student employment (*full-time employment, summer jobs, internships, cooperative education, parttime employment, post-graduation employment*) and career counseling. Students and employers are given professional and competent assistance to reach their specific employment needs.

Services of the Office include the following:

- Act as liaison between students and employers, acquainting them with career opportunities.
- Work with academic deans, faculty members and administrators to help bridge the gap between the classroom and the world of work.
- Assist students through individual and group counseling.
- Help students and alumni in identifying career search strategies.
- Provide cooperative education experiences.

Services are always performed with a conscientious and sincere interest in the students as well as the prospective employers.

The Office of Career Services is located in Room 101, Murphy Hall. Its website can be accessed at <http://www.careerserv.ncat.edu>.

Student Organizations and Activities

The University provides a well-balanced program of activities for moral, spiritual, cultural, and physical development of the students. Religious, cultural, social, and recreational activities are sponsored by various committees, departments, and organizations of the University. Outstanding artists, lecturers, and dramatic productions are brought to the campus.

A listing of student organizations, their purposes, objectives, chief officers, and advisors is published annually by the Office of Student Development. This information is also online at <http://www.ncat.edu/~studev/>.

Memorial Student Union

<http://www.ncat.edu/~memorial>

The Memorial Union functions as the “community center” for the University and its constituency by providing a diversity of services and activities. The “Union” building encompasses over 60,000 square feet of space and serves as the headquarters for the Student Government Association, the Student Union Advisory Board, Campus Ministries/A&T Fellowship Gospel Choir, Office of Student Activities, Aggie Escort Service, the Yearbook Office, computer lab and the Commuter Student Center. Additionally, the Memorial Student Union offers room accommodations for small group meetings or large banquet activities, lounge areas, self-service vending, the “Aggie Sit-In” food court, a game room, convenience store, and the Information Center.

A primary goal of the Memorial Student Union is to promote an involved community through its various services, facilities, and programs. The Union’s location, in the heart of the north campus, provides a co-curricular community for students, faculty members, alumni, and guests served by the University. The programming and recreational activities of the Student Union Advisory Board have a unique focus on the cultural and social development of the student community.

Veterans’ Affairs and Disability Support Services

North Carolina A&T State University is an approved University for veterans and veteran dependents who wish to attend and receive educational benefits.

Persons wishing to attend the University under the Veterans’ Administration Educational Training Program should apply to the Veterans’ Administration for a Certificate of Eligibility. Simultaneously, they should apply for admission to North Carolina A&T State University through normal admissions procedures. The issuing of a Certificate of Eligibility by the Veterans’ Administration does not automatically assure a student of admission to the University. The student must be admitted in a non-provisional status.

The office is located in Suite 005, Murphy Hall, and has been established to assist veterans with enrollment and adjustment to college life. Upon enrolling at the University, veterans or eligible persons should report to the Office of Veterans’ Affairs for certification. If a Certificate of Eligibility has not been issued, the veteran or eligible persons should see the University Certifying Official.

Disability Support Services

The Office of Disability Support Services is established to assure ready accessibility of all academic programs, services, and activities, to any person with a disability matriculating at the University. Likewise, it focuses on facility accessibility.

The Office serves as a liaison for all students with disabilities as they participate in programs and activities enjoyed by all students. Additionally, the office arranges for any needed academic adjustments and/or reasonable accommodations. Current documentation is required. All information and services for persons with disabilities are handled through this office located in Suite 005, Murphy Hall. Students are encouraged to take advantage of these services.

Minority Affairs

The Office of Minority Student Affairs was created in order to assist minority (Native and Asian American, Caucasian and Hispanic/Latino) students in the development and accomplishment of their educational goals. Housed in Suite 219 of the Memorial Union, Minority Student Affairs is open from 8:00 a.m. to 5:00 p.m. and is staffed by the director and secretary. Minority students represent approximately twelve percent (12%) of the student population.

This means about 850 minority students are enrolled at North Carolina Agricultural and Technical State University. Efforts to serve these students are designed to increase the reten-

tion and graduation of minority presence students through activities, newsletters, workshops, mentoring programs, surveys, counseling, and numerous program outreach services that focus on personal development and campus involvement.

The Minority Student Association offers leadership opportunities and social activities for minority students, often in cooperation with other campus organizations.

Bookstore

The Bookstore is responsible for selling and distributing textbooks, study aids, student supplies, departmental supplies, and souvenirs to the students, faculty, and staff. The bookstore is located in the Brown Hall. The telephone number is 336-334-7593.

Student Development Services

The Division of Student Affairs shoulders the major responsibility for Student Development Services. The Vice Chancellor for Student Affairs is the Chief Administrative Officer. The division is comprised of fourteen departments assigned to four major units that are supervised by the Assistant Vice Chancellor for Student Development, Assistant Vice Chancellor for Career Services, Associate Vice Chancellor for Student Affairs, and Director of Housing.

Student Development Services at the University are organized for the purpose of providing programs and services that complement the academic mission of the University and contribute to the intellectual, social, moral, cultural, and physical development of students. These programs and services are designed to meet the expressed out-of-classroom needs of students while they pursue academic careers at the University.

As a support unit to the academic process, Student Affairs works with students in areas of counseling, leadership development, housing, and student activities. Such activities assist students in finding a sense of belonging, responsibility, and achievement. The Division carries out its purpose through goals given below:

1. To provide leadership development opportunities for student leaders, Student Government Association, Student Union Advisory Board, and other student organizations such as sororities and fraternities.
2. To provide improved services for students that impact upon their personal development.
3. To develop activities and programs that accommodate the special needs of commuter and adult students.
4. To provide programs to accommodate the special needs of minority students.

Consistent with the overall goals of the University, Student Development Services include the following programs and activities: (1) Counseling Services, (2) Career Services, (3) Student Government Association, (4) Student Activities and Publications, (5) Health Services, (6) Intramural Sports, (7) Veterans and Disabilities Support Services (8) Student Support Services, (9) Housing and Residence Life, (10) Student Union, (11) International Student Affairs, (12) Upward Bound Program, (13) Student Development, and (14) Minority Affairs. Some of the specific services are described below:

Counseling Services

The University makes provisions for counseling, testing, and guidance for all students through Counseling Services, located in 108 Murphy Hall.

Counseling Services conducts a testing program for all freshman students. The results of this program are used to assist freshmen in the planning of their educational and vocational careers. The Office conducts other testing programs that are required or desired by the departments of the University.

Counseling Services offers students the opportunity to discuss with a trained professional counselor or clinical psychologist any questions, dilemmas, needs, problems, or concerns involving educational, career, social, personal, or emotional adjustment that may occur during the college years.

The following is a list of services available through Counseling Services:

1. Individual and group personal counseling.
2. Academic and Career Counseling.

3. Individual test administration and interpretation covering the areas of intelligence, aptitude, personality, interest, achievement, and other areas requiring special needs.
4. University Diagnostic and Placement Testing Program for all freshmen to assist in the planning of their educational and vocational careers and other programs required or desired by departments of the University.
5. College Level Examination Program (CLEP) for Course Credit by Examination.
6. National Testing Program which includes administration of the Graduate Record Examinations, National Teacher Examinations, Graduate Management Admission Test, Veterinary College Admissions Test, and other similar examinations.
7. Graduate student internship training laboratory.
8. Graduate school information and cooperation in the placement of graduates who desire to pursue graduate studies.
9. Withdrawal exit interviews.
10. Outreach counseling programs and activities.

All counseling is voluntary, free of charge, private, and confidential.

DRUG AND ALCOHOL EDUCATION POLICY

Preamble:

The basic mission of North Carolina Agricultural and Technical State University is to provide an educational environment that enhances and supports the intellectual process. The academic community, including students, faculty, and staff, has the collective responsibility to ensure that this environment is conducive to healthy intellectual growth. The illegal use of harmful and addictive chemical substances and the abuse of alcohol pose a threat to the educational environment. Thus, this Drug and Alcohol Education Policy is being promulgated to assist members of the University community in their understanding of the harmful effects of illegal drugs and alcohol abuse; of the incompatibility of illegal drugs and the abuse of alcohol with the educational mission of the University; and of the consequences of the use, possession, or sale of such illegal drugs, and the abuse of alcohol, including the violation of applicable laws.

Objectives:

- I. To develop an educational program that increases the University community's knowledge and competency to make informed decisions relative to the use and abuse of controlled substances and alcohol; and
- II. To increase those skills and attributes required to take corrective action conducive to the health and well being of potential drug and alcohol abusers.

Program Components:

There are five (5) components to this policy:

- I. Education
- II. Health Risks
- III. Rehabilitation
- IV. Sanctions
- V. Dissemination and Review.

I. EDUCATION

It is the intent of the Drug and Alcohol Education Policy of North Carolina A&T State University to ensure that all members of the University community (i.e., students, faculty, administrators, and other employees) are aware that the use, sale, and/or possession of illegal drugs and the abuse of alcohol are incompatible with the goals of the University. Moreover, each person should be aware that the use, sale, or possession of illegal drugs and the abuse of alcohol is, as more specifically set forth later in this policy, subject to specific sanctions and penalties.

Each member of the University family is reminded that in addition to being subject to University regulations and sanctions regarding illegal drugs and the abuse of alcohol, he/she is also subject to the laws of the State and of the nation. Each individual is also reminded that it is not a violation of "double jeopardy" to be subject to the terms of this policy as well as the provisions of the North Carolina General Statutes. For a listing of relevant State criminal statutes, please see Appendix A. Further questions may be directed to the Office of the University Attorney or the Office of Student Affairs.

Each member of the University community is asked to pay particular attention to the full consequences of the sanctions specified in this policy, as well as to the consequences of the North Carolina criminal law referenced above. Certain violations may jeopardize an individual's future as it relates to continued University enrollment or future employment possibilities, depending on individual circumstances.

Further, it is a policy of the University that the educational, legal, and medical aspects of this issue be emphasized on an annual basis through the provision of programs and activities in the following areas:

- (a) Annual Drug and Alcohol Education Week - Workshops and seminars on drug abuse led by former drug addicts and community agencies such as MADD, SADD, and the Sycamore Center;
- (b) Drug and Alcohol Awareness Fair - Exhibits featuring drug and alcohol related paraphernalia;
- (c) Media presentations on University radio station, WNAA, emphasizing the most current programs with drug and alcohol education messages;
- (d) "Home for the Holidays, Don't Drink and Drive"; Drug and Alcohol Abuse

- Prevention Campaign;
- (e) Publication of brochure on drug education;
- (f) Continual monthly outreach programs in each residence hall.

Although directed primarily to the student population, these educational programs shall also be open to participation by all categories of University employees. Additionally, the Staff Development Office is the designated University department responsible for the planning and implementation of drug and alcohol education programs geared toward the special needs of the faculty and staff. Among the programs to be implemented by the Staff Development Office are lunchtime seminars jointly conducted by the Sycamore Center, the Greensboro Police Department, and the Guilford County Mental Health Department.

II. HEALTH RISKS

Health risks associated with the use of illicit drugs and the abuse of alcohol are wide-ranging and varied depending on the specific substance involved and individual abuse pattern. These risks include, but are not limited to the following:

1. Physical changes which alter bodily functions such as severely increased or decreased cardiac output; shallow to irregular respiration; and damage to other major organs, such as kidney, liver and brain;
2. Emotional and psychological changes including paranoia, depression, hostility, anxiety, mood swings, and instability;
3. Additional health risks could include such illnesses as AIDS-HIV infection, sexually transmitted diseases, severe weight loss, cancer, cirrhosis, hepatitis, short-term memory loss, seizures, and deformities to unborn children;
4. Physical and psychological dependency (addiction); and
5. Death from overdose or continual use.

While these health risks are broad in range, persons consuming illicit drugs and alcohol will experience some, if not all, of the above symptoms. See Appendix A for a list of a few specific drugs and their corresponding health risks.

III. REHABILITATION

The University recognizes that rehabilitation is an integral part of an effective drug and alcohol policy. Consistent with its commitment in the areas of education and sanctions, the University intends to provide an opportunity for rehabilitation to all members of the University family. This commitment is evidenced through access to existing University resources and is furthered by referrals to community agencies.

Students

The University Counseling Center and the Student Health Center are available to provide medical and psychological assessment of students with drug/alcohol dependency and drug/alcohol abuse problems. Based on the outcome of this assessment, treatment can be provided by either or both of these centers. If, however, the scope of the problem is beyond the capability of these Centers, affected students will be referred to community agencies such as the Guilford County Mental Health Center and Greenpoint. The cost of such services shall be the individual's responsibility.

Employees

Referrals to local community agencies will be made available to include the Guilford County Mental Health Center, Greenpoint, and private physicians. The cost of such services will be the individual's responsibility. The services of the University's Counseling and Health Centers are not normally utilized by faculty and staff members except in emergency situations.

IV. SANCTIONS

A. Illegal Drugs/Prohibited Conduct

All members of the University community have the responsibility for being knowledgeable about and in compliance with the provisions of North Carolina Law as it relates to the use, possession, or sale of illegal drugs as set forth in Article 5,

Chapter 90 of the North Carolina General Statutes. Any violations of this law by members of the University family subjects the individual to prosecution both by the University disciplinary proceedings and by civil authorities. It is not a violation of “double jeopardy” to be prosecuted by both of these authorities. The University will initiate its own disciplinary proceedings against a student, faculty member, administrator, or other employee when the alleged conduct is deemed to affect the interests of the University.

Penalties will be imposed by the University in compliance with procedural safeguards applicable to disciplinary actions against students (see the Student Handbook), faculty members (see the Faculty Handbook), administrators (see the Board of Governors Policies Concerning Senior Administrative Officers as well as the EPA Non-Teaching Personnel Policies), and SPA employees (see State Personnel Commission Policies).

The penalties imposed for such violations range from written warnings with probationary status to expulsion from enrollment and discharge from employment. However, minimum penalties that apply for each violation are listed in Appendix A. For additional information, direct questions to the Office of the University Attorney or the Office of Student Affairs. It should be noted that where the relevant sanction dictates a minimum of one semester suspension from employment, the regulations of the State Personnel Commission (as pertaining to SPA employees) do not permit suspension from employment of this duration. Thus, such sanction as applied to SPA employees dictates the termination of employment.

B. Alcohol/Prohibited Conduct

1. Employees

While the sale, possession, or consumption of alcoholic beverages is not illegal under state or federal law, it is, hereby, the policy of North Carolina A&T State University that the consumption of alcohol sufficient to interfere with or prevent otherwise normal execution of job responsibilities is improper and subjects the employee to appropriate disciplinary procedures. It is also the policy of North Carolina A&T State University that alcoholic beverages not be sold on campus. Employees violating these policies are subject to appropriate disciplinary procedures, which may range from warning and probation to dismissal consistent with the individual circumstances.

Similarly, employees are reminded that, under N.C. Law, it is illegal to sell or give malt beverages, unfortified wine, fortified wine, spirituous liquor, or mixed beverages to anyone less than 21 years old. It is also illegal to aid and abet any person less than 21 years old in the purchase or possession of these alcoholic beverages. Employees found violating these state laws are subject to legal sanction as well as the appropriate disciplinary procedures.

2. Students

Students are reminded of the following University regulations and state laws regarding alcoholic beverages as contained in the Student Handbook.

1. Students are liable for violation of State Law GS 18B-302 while on University premises: 18B-302 Sale to or Purchase by Underage Persons

a. Sale - It shall be unlawful for any person to

I. Sell or give malt beverages or unfortified wine to anyone less than 21 years old; or

II. Sell or give fortified wine, spirituous liquor, or mixed beverages to anyone less than 21 years old.

b. Purchase or Possession - It shall be unlawful for

I. A person less than 21 years old to purchase, to attempt to purchase, or to possess malt beverages, or unfortified wine; or

II. A person less than 21 years old to purchase, to attempt to purchase, or possess fortified wine, spirituous liquor, or mixed beverages.

c. Aider and Abettor

I. By Underage Person - Any person under the lawful age to purchase who aids or abets another in violation of subsection (a) or

(b) of this section shall be guilty of a misdemeanor punishable by a fine of up to five hundred dollars (\$500.00) or imprisonment for

not more than six months, or both, at discretion of the court.

II. By Person over Lawful Age - Any person who is over the lawful age to purchase who aids or abets another in violation of subsection (a) or (b) of this section shall be guilty of a misdemeanor punishable by a fine of up to two thousand dollars (\$2,000) or imprisonment for not more than two years, or both, at the discretion of the court.

2. Students are responsible for conforming to state laws pertaining to

a. Transportation of alcoholic beverages

b. Consumption of alcoholic beverages in public places

c. Consumption of alcoholic beverages by students under the legal drinking age

d. Abuses of alcoholic beverages.

3. There will be no consumption of alcoholic beverages in a motor vehicle while on University property or on University streets.

4. Consumption of alcoholic beverages is restricted to students' rooms in residence halls, if they are of legal drinking age.

5. The possession or consumption of alcoholic beverages shall not be permitted in public places; that is: lounges, game rooms, study rooms, kitchens, laundries, or patios.

6. There will be no public display of alcoholic beverages.

7. The University discourages the drinking of alcoholic beverages, and other abuses of alcoholic beverages. Being under the influence of alcohol is considered a breach of conduct and students who violate these standards are subject to disciplinary action.

Violations of the above regulations and laws will subject students to criminal prosecution as well as campus-based charges.

C. Suspension Pending Final Disposition

The University reserves the right through the Chancellor or his designee to suspend a student, faculty member, administrator, and other employee between the time of the initiation of charges and the hearing to be held. Such decision will be made based on whether the person's continued presence within the University community will constitute a clear and immediate danger or disruption to the University. In such circumstances, the hearing will be held as promptly as possible.

V. DISSEMINATION

A copy of the Drug and Alcohol Education Policy will be distributed on an annual basis to each employee and student of the University. A distribution to all enrolled students will occur as a part of the registration process. The distribution to University employees will be administered by the University Personnel Office.

The Chancellor of the University shall ensure on a biennial basis that this policy is reviewed to assess its effectiveness and consistency of application of sanctions, and to determine the necessity for modification. This review shall be conducted by October 15 of every other year, beginning in 1992.

CONCLUSION

North Carolina A&T State University recognizes that the use of illegal drugs and the abuse of alcohol are national problems and that sustained efforts must be made to educate the University family regarding the consequences associated with drug and alcohol abuse. The primary emphasis in this policy has, therefore, been on providing drug and alcohol abuse counseling and rehabilitation services through the various programs and activities outlined above.

Past experience suggests that most members of the University family are law-abiding and will use this policy as a guide for their future behavior and as mechanism to influence their peers and colleagues in a positive direction. However, those who choose to violate any portions of this policy will pay the penalty for non-compliance. The main thrust of this policy has been to achieve a balance between its educational and punitive components.

The effectiveness implementation of this policy rests on its wide dissemination to all members of the University family. This will be accomplished by the dissemination procedure previously outlined and through its publication in the faculty handbook, student handbook, and

University catalogue. Additionally, all affected individuals will be assured that applicable professional standards of confidentiality will be maintained at all times.

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