THE SCHOOL OF GRADUATE STUDIES

GRADUATE CATALOG

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North Carolina Agricultural and Technical State University
1601 East Market Street
Greensboro, North Carolina 27411

GRADUATE PROGRAMS
2010-2012

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GENERAL INFORMATION

HISTORICAL STATEMENT

North Carolina Agricultural and Technical State University is a learner-centered community that develops and preserves intellectual capital through interdisciplinary research, discovery, engagement and operational excellence. The university's rich history dates back over 118 years. N.C. A&T was established as the A. and M. College for the "Colored Race" by an act of the General Assembly of North Carolina ratified March 9, 1891. It was in the fall of 1890, when the North Carolina General Assembly enacted a second Morrill Act that mandated a separate college for the colored race. (The College operated in Raleigh as an annex to Shaw University during the years 1890-1891, 1891-1892, and 1892-1893). A group of Greensboro citizens banded together to make a permanent home for the institution. Members such as Dr. DeWitt, a black dentist, C. Benbow and Charles H. Moore donated 14 acres of land for the site and an additional $11,000 in cash that aided in construction of the buildings. This amount was supplemented by an appropriation of $2,500 from the General Assembly. The plan was approved on March 9, 1891, and the first building was completed in 1893: the Agricultural and Mechanical College for the Colored Race (now North Carolina A&T State University) had found its new home.

In 1915 state legislators changed the college's name to The Agricultural and Technical College of North Carolina, and in 1967 elevated its status to university. N.C. A&T became a constituent university of The University of North Carolina in 1972.

Since its inception, A&T has maintained a tradition of excellence in education. Under the leadership of Dr. Harold L. Martin Sr., the university's current Chancellor, A&T continues to thrive as it sustains its rich legacy.

N.C. A&T is a public, land-grant, institution located in Greensboro, N.C., on 200 beautiful acres. It is classified by the Carnegie Foundation for the Advancement of Teaching as a doctoral-granting research university (high research activity). There is also a 600-acre university farm. Its enrollment is more than 10,000 students and its workforce includes 2,170 employees.

The university offers 117 undergraduate degree programs, more than 58 master's degree programs, and Ph.D. programs in mechanical, electrical and industrial engineering; energy and environmental systems; and leadership studies. The academic programs are offered through the School of Agriculture and Environmental Sciences, College of Arts and Sciences, School of Business and Economics, School of Education, School of Technology, College of Engineering, School of Nursing, Joint School of Nanoscience and Nanoengineering; and School of Graduate Studies.

A&T's outstanding student body is the primary strength of the university. Students are carefully selected from thousands of applicants annually. Once enrolled, they are taught and mentored by excellent faculty, the majority of whom have earned doctoral and other degrees from some of the nation's most prestigious graduate and professional schools.

A&T graduates the largest number of African-American engineers at the undergraduate, masters, and doctoral levels and psychology undergraduates in the nation. Through its nationally accredited AACSB School of Business and Economics, the institution is among the largest producers of African American certified public accountants. True to its heritage, North Carolina A&T is home to the largest agricultural school among HBCUs and the second largest producer of minority agricultural graduates. The institution was recently awarded a prestigious National Science Foundation's Engineering Research Center (ERC) grant for biomedical engineering and nano-bio applications research.

The University has advanced to the forefront in the area of research. For the fiscal year 2008-09, A&T has generated over $57.7 million in sponsored programs and more than $6 million in appropriations for agricultural research and cooperative extension. It also generates contracts with major international companies, foundations, and federal agencies to secure funding to enhance academic programs and to provide student scholarships.

A&T is proud of its 40,000 alumni of record who occupy leadership positions across the country and around the world. These alumni spread the Aggie tradition throughout the nation, continuing to strive for excellence and to make their mark in society. Among its well known successful alumni are the Rev. Jesse Jackson Sr., civil rights activist; U.S. Congressman Edolphus Towns (D-NY); retired Maj. Gen. Charles D. Bussey; retired Brig. Gen. Clara Adams–Ender;

Ralph Shelton, founder of Southeast Fuels; Dr. Joe Dudley, Sr., founder of Dudley Products, Inc.; Alvin Attles, vice president of Golden State Warriors; former District Court Judge Lawrence McSwain; U.S. Congressman Jesse Jackson Jr. (D-ILL); former North Carolina Supreme Court Chief Justice Henry E. Frye; The Greensboro/A&T Four, Jibreel Khazan, Joseph McNeil, Franklin McCain and the late David Richmond; North Carolina legislator Alma Adams; Elvin Bethea, 2003 Pro Football Hall of Famer; Janice Bryant-Howroyd, founder and CEO of ACT 1 Group; Willie Deese, president, Merck Manufacturing Division; Donna Scott James, managing director, Lardon Associates LLC; Dmitri Stockton, president and CEO of GE Consumer Finance for Central and Eastern Europe; and the late astronaut Dr. Ronald E. McNair.

Twelve presidents/chancellors have served the university since its founding: Dr. John O. Crosby (1892-1896), Dr. James B. Dudley (1896-1925), Dr. Ferdinand D. Bluford (1925-1955), Dr. Warmoth T. Gibbs (1956-1960), Dr. Samuel DeWitt Proctor (1960-1964), Dr. Lewis C. Dowdy (1964-1980), Dr. Cleon Thompson Jr. (1980-1981, interim), Dr. Edward B. Fort (1981-1999), Dr. James C. Renick (1999- 2006), Dr. Lloyd V. Hackley (2006-2007, interim), Dr. Stanley Battle (2007- 2009) and Dr. Harold L. Martin Sr. (2009 – Present).

MISSION, PURPOSE AND GOALS OF THE UNIVERSITY

MISSION STATEMENT

North Carolina Agricultural and Technical State University is a public, high research activity, 1890 land-grant university committed to exemplary teaching and learning, scholarly and creative research, and effective engagement and public service. The University offers degrees at the baccalaureate, master’s and doctoral levels and has a commitment to excellence in a comprehensive range of academic disciplines. Our unique legacy and educational philosophy provide students with a broad range of experiences that foster transformation and leadership for a dynamic and global society.

VISION STATEMENT

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.

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 and state 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 **G**reat **G**oals **I**n **E**verything – **P**roducing **R**enowned **I**ndividuals **D**edicated **T**o **E**xcellence

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.

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 further 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 obey 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.

Sanctions of expulsion and suspension affect the student's academic status at the University. In order that students under suspension not contravene the terms of penalty, the offices of Admissions, Cashier, Financial Aid, Graduate School, Registrar, Residence Life and University Police will be notified in writing. No credit earned at another institution during the suspension period shall be transferred to North Carolina Agricultural and Technical State University. A student under expulsion or suspension is subject to arrest for trespassing if found on University property. **A student who is suspended or expelled from the University for disciplinary reasons is not eligible for a refund and forfeits any funds previously paid.**

A student who loses campus- housing privileges for disciplinary reasons and has concerns about the financial ramifications of such should contact the Office of Housing and Residence Life for guidelines and shall be governed by those guidelines.

Scheduled university judicial hearings will be held in absentia if the student fails to present him/herself at the scheduled hearing. The administrative hearing body will convene and make a decision based on the evidence at the hearing.

Furthermore, in the case of a student's failure to appear for a hearing, the evidence against the student will be considered and a decision will be based on that evidence.

Should a sanction result from a student's failure to present himself or herself for adjudication of a charge, the offices of Admissions, Cashier, Financial Aid, Graduate School, Registrar, Residence Life and University Police will be notified in writing and the student's transcript will not be released to persons outside the University until the student answers to the charge.

Any one of the following sanctions or their combinations may be imposed:

1. **Expulsion** permanently severs the relationship of the student with the University. With recommendation of a hearing panel, it will be imposed and can only be rescinded by the Chancellor. This penalty will likely prevent a student's admission to any other institution of higher education.
2. **Indefinite suspension** severs the relationship of the student with the University with no date established for the student to return. A date at which time the student may request reinstatement can be established or may be contingent on a student fulfilling one or more stipulations (e.g. resolution of criminal matters pending in the courts, psychological evaluation).
3. **Interim suspension** calls for the immediate removal of a student from the University when there is reasonable cause to believe that the alleged misconduct is of such a serious nature that his or her continued presence at the University is potentially dangerous to the health and safety of the University community, its property or its educational mission. (In cases of violations of the Student Conduct Regulations, to invoke interim suspension, the Vice Chancellor for Student Affairs or his/her designee will conduct a preliminary investigation and hearing with the student - if possible. In cases of Academic Dishonesty, the Provost/Vice Chancellor for Academic Affairs or his/her designee will conduct such an investigation. At the time, the student will be informed of the charges and given the opportunity to explain the circumstances.)
4. **Suspension** severs the relationship of the student with the University for a finite period, the terminal date of which coincides with the official ending of an academic semester or summer session.
5. **Disciplinary Probation** is a period of close scrutiny of a student by the University during which his or her conduct is under review. Disciplinary probation is imposed for a specified period of time, the terminal date of which coincides with the official ending of an academic semester or summer session. Failure to meet the requirement of the probation or furthur infraction of University policy may result in more severe sanctions including suspension or expulsion from the University. Individuals on Disciplinary probation are not eligible to hold office or obtain membership in any student group or organization; or may not be eligible for certain employment positions or participation in other campus programs.
6. **Warning** is an official reprimand, which by formal written communication, gives official notice to a student that any subsequent offense against the **Student Conduct Regulations** will likely result in more serious consequences. In cases involving violations of the Student Conduct Regulations, a copy of the letter is contained in files of the Division of Student Affairs or in the case of Academic Dishonesty, the Vice Chancellor for Academic Affairs and will be available as evidence of relevant past behavior to hearing panels.

7. In addition to the above, any one or a combination of the following may be recommended by a judicial hearing board and/or imposed by the Vice Chancellor for Student Affairs or Dean of Students in Student Conduct Regulations or in cases of Academic Dishonesty, the Provost/Vice Chancellor for Academic Affairs:

    a. Requirement of participation in community service
    b. Restitution, where applicable
    c. Loss of Campus Housing
    d. Official notice that conviction of any other violation of the **Student Conduct Regulations** will result in suspension
    e. Prohibited from participating in organized groups or activities
    f. Counseling
    g. Conflict Management Training

The penalties listed above are examples only and do not limit the discretion of judicial officers.

Students placed on suspension or expulsion are placed in the UNC Statewide Database, per state requirements.

Please note: During the suspension period, records will remain flagged and transcripts will be held until students have complied with University imposed sanctions and until the suspension period is over. In addition, suspensions and expulsions are uploaded to the UNC data base. A suspension or expulsion precludes matriculation at any UNC constituent institution.

COMPUTER USE POLICY STATEMENT

Students of North Carolina A&T State University are authorized to use computer networks, equipment and related resources pursuant to administrative regulations established and promulgated by the Chancellor or his/her designee. All students are expected to follow the computer use policy and related University rules, regulations and procedures for computer usage and work produced on computing equipment, systems, and networks of the university. Students may access these technologies for personal use on a restricted basis.

Please refer to the Computing and Networking Usage Policy and Lab Usage Policy at the www.ncat.edu/~cit/policies/ for permissible use. Any violation of these policies is considered "misconduct" subject to the University's disciplinary procedures. Sanctions for violation of this policy may include revocation or suspension of computer access privileges in addition to any other sanction permitted under student conduct and academic policies. Violations of state or federal laws may also be referred to the appropriate authorities for criminal or civil action. Students are encouraged to contact the Client Services Department or the Aggie Helpdesk for information regarding any computer usage matters.

THE UNIVERSITY OF NORTH CAROLINA

In North Carolina, all the public educational institutions that grant baccalaureate degrees are part of the University of North Carolina. North Carolina Agricultural and Technical State University is one of the 16 constituent institutions of the multi-campus state university.

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

In 1877, the NC General Assembly began sponsoring additional institutions of higher education, diverse in origin and purpose. Five were historically black institutions, and another was founded to educate American Indians. Several were created to prepare teachers for the public schools. Others had a technological emphasis. One is a training school for performing artists.

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

In 1971, the General Assembly passed legislation bringing into the University of North Carolina the state's ten remaining public senior institutions, each of which had until then been legally separate: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State University, North Carolina Agricultural and Technical State University, North Carolina Central University, the North Carolina School of the Arts, Pembroke State University, Western Carolina University, and Winston-Salem State University. This action created the current 16-campus University. (In 1985, the North Carolina School of Science and Mathematics, a residential high school for gifted students, was declared an affiliated school of the University; and in 1996, Pembroke State University was renamed The University of North Carolina at Pembroke through Legislative action.)

The UNC Board of Governors is the policy-making body legally charged with "the general determination, control, supervision, management, and governance of all affairs of the constituent institutions." It elects the president, who administers the University. The 32 voting members of the Board of Governors are elected by the General Assembly for four-year terms. Former board chairmen and board members who are former governors of North Carolina may continue to serve for limited periods as non-voting members emeriti. The president of the UNC Association of Student Governments, or that student's designee, is also a non-voting member.

Each of the 16 constituent institutions is headed by a chancellor, who is chosen by the Board of Governors on the president's nomination and is responsible to the president. Each institution has a board of trustees consisting of eight members elected by the Board of Governors, four appointed by the governor, and the president of the student body, who serves ex-officio. (The NC School of the Arts has two additional ex-officio members.) Each board of trustees holds extensive powers over academic and other operations of its institution on delegation from the Board of Governors.

ORGANIZATION OF THE UNIVERSITY

Board of Governors

The University of North Carolina

Hannah D. Gage, Chair

Brent D. Barringer	Dudley E. Flood	Franklin E. McCain
John M. Blackburn	Paul Fulton	Charles H. Mercer, Jr.
Peaches Gunter Blank	Ann B. Goodnight	Fred G. Mills
R. Steve Bowden	Clarice C. Goodyear	Burley B. Mitchell, Jr.
Laura W. Buffaloe	Peter D. Hans	Marshall B. Pitts, Jr.
Frank Daniels, Jr.	Charles A. Hayes	Irvin A. Roseman
William Daughtridge, Jr.	James E. Holshouser, Jr.	Estelle 'Bunny' Sanders
Walter C. Davenport	Adelaide Daniels Key	Priscilla P. Taylor
John W. Davis, III	G. Leroy Lail	J. Bradley Wilson
James M. Deal, Jr.	Ronald C. Leatherwood	David W. Young
Phillip R. Dixon	Cheryl R. Locklear	

Ex Officio Member

T. Greg Doucette

GOVERNANCE OF NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

North Carolina Agricultural and Technical State University is a constituent institution of The University of North Carolina. It functions under the jurisdiction of a thirty-two member Board of Governors of The University of North Carolina elected by the General Assembly of North Carolina. Policies of the Board of Governors are administered by the President of the University and his/her staff. They constitute the General Administration and are located in Chapel Hill.

The Board of Trustees of North Carolina Agricultural and Technical State University consists of thirteen members. Eight members are appointed by the Board of Governors, four are appointed by the Governor of the State, and the President of the Student Government Association serves as an ex officio member. The Board of Trustees receives its authority by delegation from the Board of Governors.

The Chancellor is the chief administrative officer of each University.

ADMINISTRATION, NORTH CAROLINA A&T STATE UNIVERSITY

Harold L. Martin, Sr., *Chancellor*
Linda Adams, *Provost and Vice Chancellor for Academic Affairs*
Robert Pomprey, Jr., *Vice Chancellor for Business and Finance*
Melody Pierce, *Vice Chancellor for Student Affaisr*
Mark Kiel, *Vice Chancellor for Development and University Relations*
Celestine Ntuen, *Interim Vice Chancellor for Research and Economic Development*
Barbara Ellis, *Interim Vice Chancellor for Information Technology and Telecommunications*
Linda R. McAbee, *Vice Chancellor for Human Resources*
Deborah J. Callaway, *Special Assistant to the Chancellor*
Earl Hilton, *Interim Director of Athletics*

DEANS OF SCHOOLS AND COLLEGES

Donald McDowell, *Interim Dean, School of Agriculture and Environmental Sciences*
David Aldridge, *Interim Dean, College of Arts and Sciences*
Quiester Craig, *Dean, School of Business and Economics*
Dorothy Leflore, *Interim Dean, School of Education*
Winser Alexander, *Interim Dean, College of Engineering*
Alan Letton, *Dean, School of Graduate Studies*
James Ryan, *Dean, Joint School of Nanoscience and Nanoengineering*
Patricia Chamings, Interim *Dean, School of Nursing*
Benjamin O. Uwakweh, *Dean, School of Technology*

COLLEGES, SCHOOLS, AND DIVISIONS OF NORTH CAROLINA AGRICULTURAL AND 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, The Joint School of Nanoscience and Nanoengineering, 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 to award baccalaureate, masters, and doctorate degrees. Contact the Commission on Colleges at 1866 Southern Lane, Decatur, Georgia 30033-4097 or call 404-679-4500 for questions about the accreditation of North Carolina Agricultural and Technical State University.

A listing of programs and their accrediting agencies follows:

American Chemical Society Certification Program – American Chemical Society

Business and Accounting programs – AACSB International – Association to Advance Collegiate Schools of Business

Child Development, Early Education and Family Studies – National Council for Accreditation of Teacher Education

Computer Science – Computing Accreditation Commission, Accreditation Board for Engineering and Technology

Construction Management – American Council for Construction Education, and National Association of Industrial Technology

Didactic Program in Dietetics – Commission on Accreditation for Dietetics Education, American Dietetic Association

Engineering: Architectural, Biological, Chemical, Civil, Electrical, Industrial and Systems, and Mechanical Engineering programs – Engineering Accreditation Commission, Accreditation Board for Engineering and Technology

Family and Consumer Sciences – American Association of Family and Consumer Sciences

Human Development and Services – Council on Accreditation for Counseling and Related Educational Programs, and Council on Rehabilitation Education

Industrial Technology – National Association of Industrial Technology

Journalism and Mass Communication – Accrediting Council on Education in Journalism and Mass Communication

Landscape Architecture – American Society of Landscape Architects

Media Program – Association of Educational Communications and Technology

Music – National Association of Schools of Music

School of Nursing – National League for Nursing Accrediting Commission

Social Work – Council on Social Work Education

Teacher education programs – National Council for Accreditation of Teacher Education, and North Carolina State Department of Public Instruction

Theater Arts Program in Acting – National Association of Schools of Theater

Below is a listing of professional organizations that the University is a member:

Accreditation Board for Engineering and Technology

Accrediting Council on Education in Journalism and Mass Communication

American Association of Colleges of Nursing

American Association of Colleges for Teacher Education

American Association of Collegiate Registrars and Admission Officers

American Association of Family and Consumer Sciences

American Association of University Women (graduates are eligible for membership)

American Chemical Society

American College Public Relations Association

American Council for Construction Education

American Council on Education

American Dietetics Association

American Library Association
American Personnel and Guidance Association
American Public Welfare Association
American Society for Engineering Education
American Society of Landscape Architects
American Society of Mechanical Engineers
Association of Educational Communications and Technology
Associated Schools of Construction
Association to Advance Collegiate Schools of Business International
Association of American Colleges
Association of College Unions International
Association of Collegiate Deans and Registrars
Association of Collegiate Schools of Architecture
College Language Association
Conference of Southern Graduate Schools
Council on Accreditation for Counseling and Related Educational Programs
Council of Graduate Schools
Council of Historically Black Graduate Schools
Council on International Education Exchange
Council on Rehabilitation Education
Council on Social Work Education
National Association of Business Teacher Education
National Association of College and University Business Officers
National Association of College and University Food Service
National Association of Industrial Technology, International Association of Technology Education
National Association of Schools of Music
National Association of Schools of Theatre
National Association of State Universities and Land Grant Colleges
National Association of Student Personnel Administrators
National Commission on Accrediting
National Consortium for Graduate Degrees for Minorities in Engineering and Science
National Council for Accreditation of Teacher Education
National Institutional Teacher Placement Association
National League for Nursing
North Carolina Association of Colleges and Universities
North Carolina League of Nursing
North Carolina Library Association
North Carolina State Department of Public Instruction
Southeastern Library Association
Southern Association of Schools and Colleges, Commission on Colleges
Southern Regional Education Board Council on Collegiate Education for Nursing
Southern Universities Research Association
University of North Carolina Exchange Program
University of North Carolina Graduate Council

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
2010-2012 Academic Calendar

FALL 2010 ACADEMIC CALENDAR

11-Aug	**Wednesday**	Faculty Institute – Faculty Report
12-Aug	**Thursday**	Graduate Student Orientation Residence Halls Open 9 AM - 3 PM For New Students Who Attended The June
13-Aug	**Friday**	Graduate Research And Teaching Assistant Training Residence Halls Open 9 AM - 3 PM For New Students Who Did Not Attend The June 2010 New Student Orientation
14-Aug	**Saturday**	Residence Halls Open 9 AM - 3 PM for Continuing Students
August 14-15	**Saturday-Sunday**	Welcome Program for New And Transfer Students
16-Aug	**Monday**	Classes Begin Late Registration Begins ($50.00 Late Fee)
20-Aug	**Friday**	Last Day To Audit A Course Last Day to Change from Audit to Credit or Credit to Audit Last Day To Drop And Receive Financial Credit Late Registration Ends (Includes Tuition Waivers)
27-Aug	**Friday**	Last Day to Add Courses Last Day to Switch Course Sections
3-Sep	**Friday**	Last Day To Apply For Fall 2010 Graduation (Undergraduate, Graduate, and
6-Sep	**Monday**	University Holiday (Labor Day)
20-Sep	**Monday**	Deadline To Remove Incomplete(s) Received Spring or Summer 2010
24-Sep	**Monday**	Last Day To Receive Book Allowance
27-Sep	**Monday**	Deadline To Apply For Certificate Programs
7-Oct	**Thursday***	Fall Convocation (Classed suspended 10 AM - 12 Noon)
9-Oct	**Saturday***	Homecoming
October 11-	**Monday-Friday**	Final Comprehensive Exam Week (Graduate Students)
October 18-	**Monday-Tuesday***	Fall Break
21-Oct	**Thursday**	Undergraduate Mid-Term Grades due Last Day to Defend Thesis/Dissertation
25-Oct	**Monday**	Defended and Approved Thesis/Dissertation Due in Graduate School Office
29-Oct	**Friday**	Last Day to Withdraw from a Course without a Grade Evaluation
1-Nov	**Monday**	Advisement and Registration For Spring and Summer 2011
5-Nov	**Friday**	Last Day To Withdraw from the University without a Grade Evaluation
November 24-	**Wednesday-Friday**	Thanksgiving Holiday
26-Nov	**Friday**	Approved Printed Thesis/Dissertation Copies For Binding Due In The Graduate
3-Dec	**Friday**	CLASSES END
4-Dec	**Saturday**	Reading Day
December 6-	**Monday-Friday**	Final Exam Week
10-Dec	**Friday**	Waste Management Certificate Ceremony
11-Dec	**Saturday**	Commencement Residence Halls Close for Non-graduating Students at 12 noon Residence Halls Close for Graduating Seniors 5:00 PM
13-Dec	**Monday**	Final Grades are due

SPRING 2011 ACADEMIC CALENDAR

3-Jan	Monday	Residence Halls Open 9:00 AM - 3:00 PM For New Students Begin Accepting Consortium Forms within the Office of the Registrar
4-Jan	Tuesday	Residence Halls Open 9:00 AM - 3:00 PM For Continuing Students Graduate Student Orientation
5-Jan	Wednesday	Graduate Research and Teaching Assistant Training
January 3-4	Monday-Tuesday	Welcome Program for New Students and Transfer Students
6-Jan	Thursday	Classes Begin Late Registration Begins ($50.00 Late Fee)
12-Jan	Wednesday	Last Day To Register to Audit A Course Last Day To Change form Audit to Credit or Credit to Audit Last Day To Drop and Receive Financial Credit Last Day to Register for Courses (Includes Tuition Waivers) Last Day To Receive Book Allowance Last Day To Receive Consortium Forms within the Office of the Registrar Last Day to Switch Course Sections
17-Jan	Monday	University Holiday (Martin Luther King Jr.)
26-Jan	Wednesday	Last Day To Apply For Graduation - 5:00PM (Undergraduate And Graduate
28-Jan	Friday	Ronald E. McNair Memorial Day
9-Feb	Wednesday	Deadline To Remove Incomplete(s) Received Fall 2010
21-Feb	Monday	Deadline To Apply For Certificate Programs
March 4	Monday - Friday	Final Comprehensive Exam Week (Graduate Students)
5-Mar	Saturday	Residence Halls Close At 1:00 PM
March 7 - 11	Monday - Friday	Spring Break
12-Mar	Saturday	Residence Halls Re-Open 9:00 AM
15-Mar	Tuesday	Undergraduate Mid-Term Grades Due Honor's Convocation (Classes Are Suspended From 3:00 PM To 5:00 PM)
18-Mar	Friday	Last Day To Defend Thesis/Dissertation
21-Mar	Monday	Defended And Approved Thesis/Dissertation Due In Graduate School Office
25-Mar	Friday	Last Day To Withdraw From A Course Without A Grade Evaluation - 5:00PM
1-Apr	Friday	Last Day To Withdraw From The University Without A Grade Evaluation -
4-Apr	Monday	Advisement And Registration For Fall 2011
22-Apr	Friday	University Holiday (Good Friday)
29-Apr	Friday	Approved Printed Thesis/Dissertation Copies For Binding Due In Graduate School Classes End
30-Apr	Saturday	Reading Day
May 2 - 6	Monday - Friday	Final Exam Week
6-May	Friday	Waste Management Certificate Program
7-May	Saturday	Commencement Residence Halls Close For Non-Graduating Students 12 noon Residence Halls Close For Graduating Students 5:00 PM
9-May	Monday	Final Grades Due

FALL 2011 ACADEMIC CALENDAR

1-Aug	**Monday**	Last day to apply for Readmission Last day to submit appeal for academic suspension or academic dismissal
August 10-23	**Wednesday thru Tuesday**	Late Registration ($50.00 late fee)
12-Aug	**Friday**	Faculty/Staff Institute - Faculty Report
13-Aug	**Saturday**	Residence Halls (open 9:00 a.m. - 3:00 p.m.) for New Students
15-Aug	**Monday**	Residence Halls (open 9:00 a.m. - 3:00 p.m.) for Continuing Students
17-Aug	**Wednesday**	Classes Begin
23-Aug	**Tuesday 11:59 p.m.**	Last day to add courses Last day to switch course sections Last day to drop a course and receive financial credit
30-Aug	**Tuesday**	Last day to receive book allowance
2-Sep	**Friday**	Last day to apply for graduation
5-Sep	**Monday**	University Holiday (Labor Day)
23-Sep	**Friday**	Last day to remove Incomplete(s) assigned Spring/Summer
October 3-7	**Monday thru Friday**	Final comprehensive exam week (Graduate Students)
13-Oct	**Thursday**	Fall Convocation (Classed suspended 10:00 a.m. - 12:00 p.m.
15-Oct	**Saturday**	Homecoming
17-Oct	**Monday**	Advisement and Registration begins for Spring/Summer
October 17-18	**Monday-Tuesday**	Fall Break
21-Oct	**Friday 11:59 p.m.**	Undergraduate mid-term grades due
21-Oct	**Friday**	Last day to defend Thesis/Dissertation
24-Oct	**Monday**	Defended and approved Thesis/Dissertation due in Graduate School Office
28-Oct	**Friday**	Last day to withdraw from a course without a grade evaluation
4-Nov	**Friday**	Last day to withdraw from the University without a grade evaluation
November 7-28	**Monday thru Monday**	Registration period for Spring/Summer
21-Nov	**Monday**	Last day to submit approved Thesis/Dissertation to Graduate School Office for binding
November 23-25	**Wednesday-Friday**	University Holiday (Thanksgiving)
1-Dec	**Thursday**	Last day of classes
2-Dec	**Friday**	Reading Day
December 5-9	**Monday-Friday**	Final Examinations
9-Dec	**Friday**	Waste Management and Global Studies Certificate Awards Ceremony
10-Dec	**Saturday**	Commencement Residence Halls close for non-graduating students at 12:00 p.m. Residence Halls close for graduating seniors 5:00 p.m.
12-Dec	**Monday 11:59 p.m.**	Final grades due

SPRING 2012 ACADEMIC CALENDAR

12-Dec	**Monday**	Last day to apply for Readmission Last day to submit appeal for academic suspension or academic
January 4-18	**Wednesday thru**	Late Registration ($50.00 late fee)
6-Jan	**Friday**	Faculty/Staff Institute - Faculty Report
8-Jan	**Sunday**	Residence Halls (open 6:00 a.m. - 12:00 Noon) for continuing and new
11-Jan	**Wednesday**	Classes Begin
16-Jan	**Monday**	Martin Luther King, Jr. Community Service Day (No classes;
18-Jan	**Wednesday 11:59 p.m.**	Last day to add courses Last day to switch course sections Last day to drop a course and receive financial credit
25-Jan	**Wednesday**	Last day to receive book allowance
27-Jan	**Friday**	Last day to apply for graduation
27-Jan	**Friday**	Ronald E. McNair Memorial Day
1-Feb	**Wednesday**	February One Celebration
17-Feb	**Friday**	Last day to remove Incomplete(s) assigned Fall
February 27 -	**Monday thru Friday**	Final comprehensive exam week (Graduate Students)
3-Mar	**Saturday**	Residence Halls close at 1:00 p.m. on Saturday
March 5-9	**Monday-Friday**	Spring Break
11-Mar	**Sunday**	Residence Halls re-open 9:00 a.m. on Sunday
12-Mar	**Monday**	Advisement begins for Fall and Summer
14-Mar	**Wednesday 11:59 p.m.**	Undergraduate mid-term grades due
15-Mar	**Thursday**	Honor's Convocation (Classed suspended 3:00 p.m. - 5:00 p.m.)
23-Mar	**Friday**	Last day to defend Thesis/Dissertation
26-Mar	**Monday**	Defended and approved Thesis/Dissertation due in Graduate School
27-Mar	**Tuesday**	Last day to withdraw from a course without a grade evaluation
April 2-21	**Monday thru Saturday**	Registration period for Fall and Summer
5-Apr	**Thursday**	Last day to withdraw from the University without a grade evaluation
6-Apr	**Friday**	University Holiday - Good Friday
16-Apr	**Monday**	Last day to submit approved Thesis/Dissertation to Graduate School
3-May	**Thursday**	Last day of classes
4-May	**Friday**	Reading Day
May 7 - 11	**Monday thru Friday**	Final Examinations
11-May	**Friday**	Waste Management and Global Studies Certificate Awards Ceremony
12-May	**Saturday**	Commencement Residence Halls close for non-graduating students at 12:00 Noon Residence Halls close for graduating seniors 5:00 p.m.
14-May	**Monday 11:59 p.m.**	Final grades due

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.

Fourteen 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), Dr. Kenneth H. Murray (2000-2006), Dr. Thomas Hassell (2006-2006), Dr. William J. Craft (2007 -2009), Dr. Kenneth Murray (2009-2009), Dr. Alan Letton (2010 -).

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

Graduate education is intended to develop specialized skills, knowledge and expertise in a particular discipline. Therefore the graduate admission process is designed to collect credentials that demonstrate the applicant's academic preparation, intellectual ability, experience, and motivation to undertake a rigorous academic program of study. The application materials for each prospective student receive individual attention and are reviewed by the Graduate Coordinator and/or program committee within the intended program. NCA&T considers all applications for graduate admissions without regard to race, color, sex, sexual orientation, national origin, disability, age or religion.

REQUIRED APPLICATION MATERIALS FOR ALL GRADUATE SCHOOL APPLICATIONS

Application, application fee, and al l supporting documents must submit directly to the North Carolina A&T State University School of Graduate Studies. The following official documents must be submitted before an application can submitted to the intended program for evaluation. Applications for admissions to all graduate programs must be accompanied by the following.

- **Official College Transcript(s)**

  One official college transcript from all post secondary institutions previously attended including community colleges and NCA&TSU must be submitted to the School of Graduate Studies. Each transcript must arrive in a sealed institutional envelope, initialed on the back flap by the certifying officer. Transcripts must be originals and carrying the official seal of the school. Student copies of transcripts and photocopies cannot be accepted.

  Applicants enrolled in a college or university at the time of application must submit an official copy of their final transcript to the School of Graduate Studies. The final transcript must show that all work has been completed and the degree requirements have been met and degree conferred. Final acceptance is contingent upon completion of the degree upon which the admission is based.

- **Application Processing Fee**

  A $45 non-refundable application fee is required. It should be noted that the application fee may change. The Graduate Studies website should be consulted to obtain the accurate application fee.

- **Three Recommendations**

  At least three recommendations from former professors or other individuals who know the applicant's academic record and potential for graduate study must be submitted. If the applicant has been out of school for a number of years and is unable to contact professors, letters from other individuals who can address his/her achievement and potential will be accepted.

- **Personal Statement Letter of Intent:**

  A personal statement which describes career goals, research interests and a list of publications, work experience, academic honors, and organizations should be submitted.

- **North Carolina Residency Form if claiming North Carolina residence for tuition purposes**

*All materials submitted as part of the graduate application become a part of the University's official record and cannot be returned to the student, nor forwarded to a third party***.**

Supplemental (Program-Specific) Application Material

Many programs require additional information of applicants. Supplemental information may include, but is not limited to standardized test scores, an additional personal statement, supplemental forms, portfolios, and essays. Applicants should check with their program of interest to determine what, if any, additional information is required. An application cannot be considered complete until all required materials are submitted.

STANDARDIZED TEST SCORES (GRE, GMAT, ETC.)

All PhD programs and many Masters Programs required that applicants submit standardized test scores.
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 the Educational Testing Service) 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.

GENERAL APPLICATION DEADLINES

Completed applications must be submitted to the School of Graduate Studies by the following deadlines:

Fall Semester	June 15th
Spring Semester	November 1st
Summer Session	April 1st

However, it should be noted that individual programs may have earlier deadlines than the general deadline stated above and all programs do not accept applications for all terms. Applicants must ensure that all applications are submitted in time to meet whichever deadline is earliest for the appropriate term.

ADDITIONAL REQUIREMENTS FOR INTERNATIONAL STUDENTS

The Admissions Process for international applicants consists of two main stages:

- acceptance into an academic degree program **and**
- Demonstration of the ability to meet requirements for the issuance of the Certificate of Eligibility (I-20/DS-2019) with which to apply for the nonimmigrant student visa.

International applicants must submit the application, application fee and all supporting credentials by the appropriate deadline. Once an applicant has been accepted into an academic program, the Graduate Admissions Office will mail the applicant a letter of acceptance. International applicants must be accepted into a degree program before advancing to stage two of the admissions process which is handled by the Office of International Students and Scholars. International students are required to meet all of the above requirements in addition to those listed below.

ENGLISH PROFICIENCY

In order to be eligible for admission to the Graduate School all international applicants, regardless of citizenship, must demonstrate proficiency in English at a level necessary to be successful in a graduate program at North Carolina A&T State University. This requirement can be met for most applicants in one of the following ways; however, some programs may require higher minimums or additional evidence of English proficiency:

- Provide **Test of English as a Foreign Language** (TOEFL) with a total score of ***at least 79*** on the Internet-based Test (iBT). *The current computer- and paper-based versions of the TOEFL test will be given until the* *iBT version is implemented in a particular location. Computer-based TOEFL scores must be 213 or higher. The paper-based test requires a score of 550 or higher.*

- Provide **International English Language Testing System** (IELTS) scores with an overall band score of ***at least 6.5***.
- Successful completion of **INTERLINK**, the intensive English language program located on the campus of the University of North Carolina at Greensboro or
- Hold a degree from an accredited four-year US college or university or have successfully completed at least two years of full-time study in a degree program at US college or university.

EVALUATION OF TRANSCRIPTS FROM INTERNATIONAL INSTITUTIONS

Official academic transcripts from all international universities are required along with a certified English translation and a course by course transcript evaluation completed and forwarded directly to the School of Graduate Studies by an external agency. North Carolina A&T State University accepts transcript evaluations from the following agencies: Educational Credential Evaluators, Inc. (www.ece.org) and World Education Services (www.wes.org). Evaluations completed by other agencies are not recognized nor 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.

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 isso@ncat.edu at (336) 334-7551.

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 School of Graduate Studies 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 at 336-334-7551 or at isso@ncat.edu.

All documents submitted as a part of a graduate application become part of the permanent record and cannot be released to another institution, employer, or to the student.

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. Satisfying minimal standards, however, does not guarantee admission, since the number of eligible applicants generally far exceeds the number of places available. The ability to accept students is governed by available resources as well as by the applicant's potential to succeed in graduate education. As a result, qualified applicants may not be accepted.

Applicants to a master's degree program for graduate study must have earned a bachelor's degree from a nationally accredited or regionally accredited four-year college. Application forms must be submitted to the School of Graduate Studies with an official transcript of all previous undergraduate and graduate studies, and three letters of recommendation

UNCONDITIONAL ADMISSION

The following criteria are required to qualify for unconditional admission to a master's degree program for graduate study:

An applicant must have a Bachelor's degree from an accredited college or university as determined by a regional or national accrediting agency.

An applicant must have earned an overall average of 2.8 on a 4 point system (or 2.0 on a 3 point system) in his/her undergraduate studies. Some programs require a higher minimum GPA therefore, applicants should check appropriate sections of the Graduate Catalog to ascertain the minimum grade point average required.

Meet additional program requires as indicated by specific graduate program. Applicants should consult departments for additional specific program requirements.

CONDITIONAL

Conditional admission is granted when the department or the graduate school determines the student has not met the requirements for unconditional admission. . Conditional admission may be granted to a student when some type of deficiency is noted in the student's academic work.

The following criteria are used to determine conditional admission:

- Students with related Bachelor's degrees and overall undergraduate GPAs that fall below the required minimum.
- Students with related Bachelor's degrees from accredited institutions whose academic records are below the standards for unconditional admissions may be granted conditional admission when, a) unavoidable, extenuating circumstances affected their undergraduate grade point averages, or b) their undergraduate course work reflects progressive improvement.
- Students with non-related Bachelor's degrees from accredited institutions who lack undergraduate work considered essential for graduate study in a major field may be granted conditional admission.

Students admitted conditionally may be suspended without a probationary period if the conditions placed on their admission have not been met.

CONDITIONAL ADMISSION

An applicant may be admitted to the master's degree program for graduate study on a conditional 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 conditionally 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.

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 official transcripts of all 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 conditional 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.

All College of Engineering programs, Electrical Engineering, Industrial and Systems Engineering, and Mechanical Engineering allow BS graduates with an earned GPA of 3.5 or higher to apply directly to the Ph.D. program. Applicants should contact the respective engineering department for more information on this option.

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 for Leadership Studies and Energy and Environmental Studies. 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.

CONDITIONAL ADMISSION

Conditional admission is offered to applicants who meet all conditions except the 3.5 grade point average in the master's degree. Conditional students must convert to unconditional admission on a timely basis by achieving a 3.5 average on graduate coursework at the end of the semester in which the the ninth credit of graduate coursework is completed.

Graduate admission, Master's and Doctoral, 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. Admission is given to a specific graduate program. While an individual may apply to and be accepted by multiple graduate programs, graduate enrollment is limited to one program. Students may not enroll in or pursue dual degrees simultaneously.

Students denied admission to one academic program must re-apply for admission to be considered by another academic department.

JOINT DOCTORAL PROGRAM IN TECHNOLOGY MANAGEMENT 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

- 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.
Completed application mailed to the School of Graduate Studies at Indiana State University. The on-line application can be found at swww.indstate.edu/grad/applications.html.

- Bachelor' degree from an accredited university with a minimum undergraduate grade point average of 3.0 on a 4.0 scale.
- Minimum cumulative master's level 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.

DEFERRAL OF ADMISSION

Students who do not enroll in the semester in which they were admitted must submit a written request to the School of Graduate Studies and the graduate program to defer admission to another semester. The School of Graduate Studies and the graduate program must approve this request. The maximum time that a student may be granted a deferral is one year beyond the initial semester in which he/she received admission. If a student does not enroll in the semester in which he/she received admission or submit a written request for deferral, the student's admission will be rescinded.

READMISSION

A student must reapply if he/she has been terminated at NC A&T State University because of non-compliance with the continuous registration policy and wishes to resume study in his/her original graduate program. The student must submit the complete application packet including the application fee as if applying for the first time.

POST-BACCALAUREATE STUDIES (PBS)

Post Baccalaureate Studies (PBS) allows an individual who has completed an undergraduate degree and is interested in taking graduate level courses to do so. PBS is a non degree status; students admitted in this status are admitted to the School of Graduate Studies, but not to a North Carolina A&T State University graduate degree program. Therefore a student cannot earn a graduate degree as a PBS student.

Should a PBS student desire to pursue a degree he/she must submit a graduate application and all required documentation, including application fee, to the School of Graduate Studies as outlined in the School of Graduate Studies catalog and webpage. PBS students who have been enrolled and who subsequently apply and are accepted in to degree seeking status may have a maximum of twelve semester hours earned as a PBS student apply towards a degree program. The decision as to how many credits to transfer is at the discretion of the graduate department.

Students may take courses for graduate credit, but, at the discretion of the program, may not apply more than 12 credit hours to any program leading to a graduate degree at North Carolina A&T State University. Some academic departments restrict their courses to degree-seeking students only. Rehabilitation, Agency and Community Counseling along with the Joint Master of Social Work (JMSW) programs do not allow PBS enrollment in courses. Individuals interested in these programs must apply as a degree seeking student.

Individuals who desire to enroll as PBS students must complete the PBS application and submit the $45 application fee and a copy of their official college transcript indicating that the undergraduate degree has been conferred.

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 M.S. 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.

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 full-time (9 or more credit hours) 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 complete and file official withdrawal forms. These forms may be obtained from the Office of Counseling Services. They should be completed and submitted to the Office of the Registrar.

Students who withdraw from the University prior to the published deadline to withdraw from the University shall receive a "W" in all classes enrolled. Failure to execute and file these forms in a timely manner will result in a student incurring the penalty of receiving an “F” for each course in which he or 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 students’ optimum scholastic achievement. An absence, excused or unexcused, does not relieve the student of any course requirement.

Attendance is required and punctuality is expected*!* A student is responsible for all the work, including tests and written work, of all class meetings.

INSTRUCTOR’S RESPONSIBILITY

1. 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 or 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 makeup work of any work required by the instructor, and
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 any required course work which may be performed or due 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 make up of required work – Sickness; death of relatives (immediate family); participation in approved University related activities; acting in the capacity of a representative of the University (band, choir, sports related travel, etc.); and extraordinary circumstances (court appearance, family emergency, etc.). NOTE: Other reasons for requesting make up of required course work are not acceptable.
d. Documentation – Verification of sickness requires a signed statement of a physician or a duly authorized staff member of the Sebastian Health Center. Verification of death requires a signed statement from the Minister or Funeral Director. Verification of participation in University related activities requires a signed statement from the appropriate University official. Verification of other reasonable circumstances; for example, court appearance, family emergency, etc. requires a signed statement from an appropriate official (e.g., Court Official, parent or guardian, etc.).

The policy regarding make-up of required course work is as follows:

1. A student may petition an instructor to make up required course work whenever the student has a permissible reason for requesting make up of required course work.
2. A student will be required to present documentation which certifies absence constituting permissible reason.
3. Whenever possible, a student should consult with the instructor prior to an absence which will involve the failure to do required course work. Arrangements for make up should be discussed and agreed upon at this time.
4. A student must petition for make up of required course work on the first day that he or she returns to class.
5. If permission is granted to make up required course work, the instructor and the student should agree on an acceptable date for completion of missed required course work.
6. Failure to comply with item 4 may result in the denial to make up required course work.

Instructors should schedule make up work at a time that is convenient to both the instructor and the student.

GRADE REPORTS

Grades are available on-line at www.ncat.edu, AGGIE ACCESS as soon as grades are determined at the end of each semester.

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: Student's name, address, E-mail address, telephone number, date and place of birth, school, major, dates of attendance, degree(s) 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 submit a written request to the Office of the Registrar prior to the end of the add/drop period for the semester in which he or she 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. Students have the right to inspect and review any and all official records, files, and data directly related to them.
3. A student who believes that his or her record contains inaccurate or misleading information shall have an opportunity for a hearing to challenge the content of the record, to assure that the record is not inaccurate, misleading, or otherwise in violation of his or 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 include the student's own statement of explanation.
4. The University will comply with requests for records within a reasonable period of time and not later than (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 or her financial obligations to the University.
6. Copies of the "University's Statement" concerning access to student records are available in the Office of the Registrar as well as the office of each school 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. Failure to do so can result in a delay in the handling of the student's records and in sending official University notifications to the student's home. To change a name a student must first have a legal court document.

Transcripts of Records

Students needing an official transcript should submit a completed Transcript Request Form to the Office of the Registrar at least one week before the official transcript is needed. Transcript requests are not processed for any student or alumnus with an obligation to the University such as unpaid fees, overdue loans, library books, audiovisual equipment, or whose admission records are not complete. The completed transcript request should contain the student's name (at the time they attended), student identification number, date of birth, the name and address of where the transcript is to be sent, and the student's signature. The cost is $4.00 per copy. Unofficial transcripts may be obtained via Aggie Access On-Line (http://www.ncat.edu).

INDEBTEDNESS TO THE UNIVERSITY

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

ACADEMIC DISHONESTY POLICY

North Carolina Agricultural and Technical State University is committed to a policy of academic honesty for all students. Examples of Academic Dishonesty include but are not limited to:

- 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 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 reserve 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; or
- 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 award 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.

DISRUPTIVE BEHAVIOR IN THE CLASSROOM

(UNC-GA Policies for Students-Adopted by BOG October 26, 1970)

The instructor may withdraw a student from a course for behavior he deems to be disruptive to the class. The grade assigned will be "W" if the behavior occurs before the deadline for dropping a course without academic penalty, and the instructor has the option of giving a "W" or a "F" if the behavior occurs after the deadline.

BINDING PROCEDURES FOR INSTRUCTORS

The instructor must provide an opportunity for the student to be heard. In providing this opportunity, the instructor must follow the procedure described below:

1. The student should be notified in writing at the next class attended that the instructor proposes to drop the student from the course for disruption of the class, and the instructor should provide the student with written instructions regarding the time and place for a meeting with the instructor. A copy of this written notification must be sent to the instructor's department head at the same time.

2. A time limit of five working days (M-F) from the time written notification is given for the student's opportunity to be heard by the instructor.

3. The date of notification establishes whether the withdrawn student will be given a "W" or "F." "W" is appropriate before the 8-week drop date and either "W" or "F" is appropriate after that date, at the instructor's discretion.

4. The instructor may suspend the student from class until the instructor takes final action to withdraw the student from class or to allow the student to continue in the class. The final decision to withdraw or continue the student is the instructor's.

5. Either party in the resolution of this dispute may invite one other person of the university community to be present as an observer.

STUDENT'S RIGHT TO APPEAL

If the student wishes to appeal the instructor's decision to withdraw the student from class, he/she should follow the academic appeal procedures.

CELL PHONE POLICY

The use of cell phones inside the classroom during the classroom period is prohibited. Please be advised that placing or receiving calls as well as conversing on cell phones during the conduct of a class shall be considered as disruptive behavior for students and unprofessional behavior for faculty and staff.

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

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.

North Carolina A & T State University
Tuition & Fees Rate

IN-STATE GRADUATE STUDENTS

No. of Hrs.	Tuition	Fees	Total
1-2	$363.50	$132.87	$496.37
3-5	$727.00	$217.75	$944.75
6-7	$1,090.50	$649.63	$1,740.13
8	$1,090.50	$1,244.50	$2,335.00
9 or more	$1,454.00	$1,244.50	$2,698.50
Thesis Only	$496.37		

OUT-OF-STATE GRADUATE STUDENTS

No. of Hrs.	Tuition	Fees	Total
1-2	$1,456.62	$132.87	$1,694.49
3-5	$3,123.25	$217.75	$3,341.00
6-7	$4,684.88	$649.63	$5,334.51
8	$4,684.88	$1,244.50	$5,929.38
9 or more	$6,246.50	$1,244.50	$7,491.00
Thesis Only	$1,694.49		

SPECIAL FEES

Fee for processing admission application	$45.00
Late Registration	$50.00
Graduation fees:	
Diploma	$60.00
Transcript	$4.00
Master's Thesis and Dissertation binding fee	$8.00 (per copy)

EXPENSES AND FINANCIAL AID

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 $12,668 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.

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. 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 (exactly 365 days) immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, twelve months' (exactly 365 days) 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 for such classification, who must show his or her entitlement by the preponderance (the greater part) of the residentiary 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 parent(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, non-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 insure 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 residentiary 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 residentiary acts accompanied by residentiary 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 applicable 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 statute 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 end 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 twelve-month 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/she is treated as a new student by the institution to which he/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. 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 School Counseling, Community Counseling and Social Work 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

Students born in 1957 or later, and 18 years of age or older

DTP with Td or Tdap	Polio	Measles	Mumps	Rubella
3 * [A]	0	2 * [C]	1 * [D]	1 * [D]

*A-DTP: One of these three must be a Td or Tdap booster within the last 10 years
*C- Measles: Both doses on or after 12 months of age (If attended 4 year college in United States prior to July 1, 1994 only 1 measles is required on or after 12 months of age)
*D- Mumps and Rubella: One dose of each on or after 12 months of age

Students born before 1957

DTP with TD or Tdap	Polio	Measles	Mumps	Rubella
3 * [A]	0	0	0	1 * [D]

*A-DTP: One of these three must be a Td or Tdap booster within the last 10 years
*D-Rubella: One dose on or after 12 months of age

Students 50 years of age of older

DTP with Td or Tdap	Polio	Measles	Mumps	Rubella
3 * [A]	0	0	0	0

*A-DTP: One of these three must be a Td or Tdap booster within the last 10 years

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

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 University0
Greensboro, North Carolina 27411
Attention: Medical Records

HEALTH SERVICES

http://wwcat.edu/~health

The Director 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.
7. **Student Health Insurance**: The University requires graduate students in degree-seeking programs to be enrolled in major medical insurance. Students are automatically charged for the Student Health Insurance Plan when they register for classes and will need to complete an on-line waiver if they have their own health insurance. Students who do not have major medical insurance coverage will have to purchase the University Insurance Plan.

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) 256-2421-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 small groups 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 130 international students attend the University and represent 50 countries.

All foreign born students applying to the University are required to verify their eligibility to enroll in the University. This requires that international applicants maintain close contact with the International Students and Scholars Office (ISSO) 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) 285-2366.

While attending North Carolina A&T State University, non-immigrants are required to maintain lawful status with the **United States Citizenship and Immigration Service (USCIS)** and the Department of State (DoS). 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 Studies
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 US**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 number and 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 208 Murphy Hall. Phone (336) 334-7551, Fax (336) 256-2421. **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 through the University. Government sponsored students should **consult the ISSO advisor immediately regarding coverage**. **N**on-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 sixty-five fields and the doctorate in nine 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.

The University uses the department prefix, followed by a three-digit number, to designate all course offerings. The first digit indicates the classification level of the course. The numbering system is as follows:

100-399 - lower level courses primarily for freshmen and sophomores
400-599 - upper level courses primarily for juniors and seniors
600-699 - courses for undergraduate seniors and graduate students
700-799 - courses for graduate students and appropriate professional students' special programs
800-899 - courses for doctoral students
900-999 - courses for graduate students (999 continuation of thesis courses)

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.

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.

TRANSFER OF CREDIT

GENERAL GUIDELINES

Requests for courses to be transferred for credit toward a graduate degree are reviewed by the School of Graduate Studies upon recommendation by the student's academic program. General rules governing transferred credit are:

1) The University is not obligated to accept any courses for transfer credit.
2) To request approval to receive transfer credit, the student must submit a *Request for Transfer of Credit* form (available on the School of Graduate Studies website), approved by the program chairperson or designated graduate program coordinator, to the Dean of the School of Graduate Studies. If the courses being transferred are from another institution, the student must include an official copy of the transcript and published course descriptions along with the request.
3) The grade in any course accepted for transferred credit must be at least "B" or 3.0 on a 4.0 scale ("B-" is not equivalent to a "B"). It should be noted that, although the credit for a course may transfer, the grade will not be used to calculate the graduate GPA at North Carolina A&T State University except when the course is a consortium course.
4) The number of semester credit hours transferred from courses taken in a quarter system will be two-thirds of the quarter hours.
5) Courses that have been graded on a Pass/Fail or Satisfactory/Unsatisfactory basis will not be accepted for transfer.
6) To be considered for transferred credit, the courses must have been undertaken at a regionally accredited institution.
7) Transferred courses must be graduate-level courses relevant to the graduate degree being sought.

8) Transfer of Master's project or thesis or Doctoral dissertation credits, from one North Carolina A&T State University program for which a degree has not been awarded, to another program is permitted, if the academic program determines that the work complies with their own general standards and requirements.
9) Students who wish to take one or more courses at another institution must first consult their North Carolina A&T State University graduate degree program to determine if the transfer credit for the external courses will be accepted. Once external course credit is earned, the procedure for transferring the credits is the same as described above.
10) The School of Graduate Studies does not accept transfer credit for non-credit courses, such as lifetime learning seminars and programs, and courses taken for Continuing Education Units.
11) Transferred credits will not be included in program residence credit calculations.
12) Transfer credit is not awarded for non-degree seeking graduate students who are admitted as post-baccalaureate (PBS) students.
13) Student must complete one semester at North Carolina A&T State University before a transfer of credit request can be submitted.

MASTER'S DEGREE PROGRAM GUIDELINES

A time limit of six years applies to transfer credit for Master's Degree Programs. Requests for transfer of credit must be approved by the student's North Carolina A&T State University graduate program.

1. ***Credits from Other Institutions***
   No more than 20% of a master's degree program's semester hours may be transfer credit from other institutions (including consortium institutions) unless it is an inter-institutional program for which a larger number of transfer credits have been agreed upon.

   Credits from a Previous Master's Degree from North Carolina A&T State University
   No more than 40% of the semester hours from a previous North Carolina A&T State University master's degree are transferable into a second master's degree program.

2. ***Credits from a Graduate Degree Earned at Another Institution***
   Courses taken at another University to satisfy the requirements for a graduate degree that was awarded are not transferable.

3. ***Credits Earned as a PBS (non-degree) Student at North Carolina A&T State University***
   A maximum of twelve (12) semester hours taken while in PBS status may be transferred into a Master's degree program.

4. ***Credits Earned at the Undergraduate Level.***
   Undergraduate courses taken at another University are not transferable for graduate credit. Graduate-level courses that appear in the undergraduate section of a student's North Carolina A&T State University transcript are only transferable if they were not counted toward the student's undergraduate degree requirements and the student satisfied all of the course requirements for graduate-level credit.

5. ***Credits from an international institution***
   Courses may not be transferred from an international institution into a master's degree program unless they are part of an inter-institutional program for which transfer credits have been agreed upon.

DOCTORAL DEGREE PROGRAM GUIDELINES

A time limit of ten years applies to transfer credit for Doctoral Degree Programs. Requests for transfer of credit must be approved by the student's North Carolina A&T State University graduate program.

1. ***Credits from other institutions***
   The amount of transfer credit that may be accepted from another institution (including consortium institutions) into a doctoral program varies by program but may never be more than 30% of the required doctoral degree semester hours unless it is an inter-institutional program for which a larger number of transfer credits have been agreed upon.

2. ***Credits from a Previous Doctoral Degree from North Carolina A&T State University***
   No more than 40% of the semester hours from a previous North Carolina A&T State University doctoral degree are transferable into a second doctoral degree program.

3. ***Credits from a Graduate Degree Earned at Another Institution***
   Courses taken at another University to satisfy the requirements for a graduate degree that was awarded are not transferable.

4. ***Credits Earned as a PBS (non-degree) Student at North Carolina A&T State University***
   A maximum of twelve (12) semester hours taken while in PBS status may be transferred into a Doctoral degree program.

5. ***Credits Earned at the Master's Level***
   Graduate-level courses taken at another University while enrolled in a Master's degree program there are not transferable for doctoral credit. Graduate-level courses that appear in the Master's degree section of a student's North Carolina A&T State University transcript are only transferable if they were not counted toward the student's Master's degree requirements and the student satisfied all of the course requirements for doctoral-level credit.

6. ***Credits from an international institution***
   Courses may not be transferred from an international institution into a doctoral degree program unless they are part of an inter-institutional program for which transfer credits have been agreed upon.

BACHELOR'S TO DOCTORAL DEGREE PROGRAM GUIDELINES

A time limit of ten years applies to transfer credit for Bachelor's to Doctoral Degree Programs. Requests for transfer of credit must be approved by the student's North Carolina A&T State University graduate program.

1. ***Credits from other institutions***
   The amount of transfer credit that may be accepted from another institution (including consortium institutions) into a bachelor's to doctoral degree program varies by program but may never be more than 20% of the required semester hours unless it is an inter-institutional program for which a larger number of transfer credits have been agreed upon.

2. ***Credits Earned as a PBS (non-degree) Student at North Carolina A&T State University***
   A maximum of twelve (12) semester hours taken while in PBS status may be transferred into a bachelor's to doctoral degree program.

3. ***Credits Earned at the Master's Level***
   Graduate-level courses taken at another University while enrolled in a Master's degree program may be transferred into a bachelor's to doctoral degree program. Graduate-level courses that appear in the Master's degree section of a student's North Carolina A&T State University transcript are only transferable if they were not counted toward the student's Master's degree requirements.

4. ***Credits Earned at the Undergraduate Level***
   Undergraduate courses taken at another University are not transferable for graduate credit. Graduate-level courses that appear in the undergraduate section of a student's North Carolina A&T State University transcript are only transferable if they were not counted toward the student's undergraduate degree requirements and the student satisfied all of the course requirements for graduate-level credit.

5. ***Credits from an international institution***
   Courses may not be transferred from an international institution into a bachelor's to doctoral degree program unless they are part of an inter-institutional program for which transfer credits have been agreed upon.

6. **Exiting Program with a Master's Degree**
   If a student in a bachelor's to doctoral degree program terminates the program and seeks to get a master's degree, all credit transfer policies governing master's degrees will apply.

See the appropriate "Degree Requirements" sections of this *Catalog* for program-specific policies.

INTER-INSTITUTIONAL 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 inter-institutional 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 inter-institutional 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.

FERDINAND DOUGLASS BLUFORD LIBRARY

F.D. Bluford Library is the intellectual heart of the campus, providing a place for interaction, collaboration, study and reflection. The library offers a dynamic learning environment that supports the research and educational efforts of its faculty, staff, and students. The physical facility offers wireless access throughout four levels, individual study spaces, group and collaboration rooms, and public computers. The library maintains a balanced collection of circulating print and non-print materials, with an ever growing collection of electronic resources available for local and remote access or for download to mobile devices. Special collections in Archives and Black Studies are also available. A Learning Resources Center, located on the lower level of Bluford Library, offers print and non-print instructional materials which support the curricula and disciplines represented in the Teacher Education Program of the University. Bluford Library continues as an officially designated partial depository for United States Government and North Carolina publications.

A highly qualified staff, a solid collection of print and non-print resources, electronic indexes and full-text databases, and ample individual and group study facilities provide an atmosphere that encourages discovery and engagement.

During the regular academic year, the library opens on Sunday at 2:00 p.m. with 24-hour service until Friday at 8:00 p.m. and on Saturday from 10:00 a.m. to 7:00 p.m. Variations in this schedule are posted at the front entrance of the library and on the library's website under "Hours."

OFFICE OF SUMMER SESSIONS AND OUTREACH

The Office of Summer Sessions and Outreach provides the opportunity to take advantage of a wide range of summer learning experiences in condensed formats that support educational, career and personal enrichment goals. These activities are designed to reach the total community with courses, workshops and programs that are offered to populations of all ages from children to the retiree. The standards of academic achievement and the quality of work required are maintained at the same level as during the regular terms.

The Office has the responsibility for planning, coordinating and administering the University's Summer Sessions and Outreach activities. These programs have been designed to help optimize student progress and to enhance the University's four-year graduation rates by providing degree-related course work for undergraduate and graduate students. Most courses are conveniently taught in five weeks allowing time for work and travel during the summer months.

The summer programs feature several convenient sessions of varying lengths: two five-week sessions, one two-week presession, one two-week intersession and one ten-week dual session which runs from the beginning of the first session through the end of the second session. Students are permitted to enroll in a maximum of seven credits each five-week session or seven credits in the dual session. Students can take one three-credit hour course during the presession and/or the intersession. There are several short courses and workshops that are scheduled within the two five-week sessions.

These programs support the attainment of educational goals for undergraduate and graduate degree candidates at the university or elsewhere and the meeting of licensure requirements for teachers and other professional personnel.

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

OFFICE OF CONTINUING STUDIES AND PROFESSIONAL DEVELOPMENT

The Office of Continuing Studies and Professional Development (OCSPD) offers certificate programs, courses, workshops and seminars for the working adult. The purpose of OCSPD is to extend the resources of the university to the community in accessible formats, and to assist in making the university a recognized expert resource for high tech, cutting edge information, professional development, and training. OCSPD is the major unit of the university providing outreach to the community-at-large. In collaboration with the academic departments, schools and colleges of the university, OCSPD offers professional development programming through industry partnerships, high tech training seminars, short courses and workshops, and conferences.

The Office of Continuing Studies and Professional Development sponsors both non-credit and contract credit programming. Continuing Education Units (CEU) may be awarded for successful completion of non-credit activities. OCSPD maintains permanent transcripts of all CEU earned.

MAJOR RESEARCH CENTERS AND INSTITUTES

- **Center for Advanced Materials & Smart Structures- Dr. Jag Sankar, Director (College of Engineering)**

  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 engineered materials, 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 to providing a rich collection of outcomes for the institutions involved and for the engineering innovation in general. Basic research in the technical thrust areas (advanced ceramics, advanced composites, surface engineered materials, materials related to energy and environment , sensors and smart structures and devices) drives the Center's activities

For more information, visit http://camss.meen.ncat.edu/camss/index.html or call (336) 256-1151.

- **Center for Autonomous Control & Information Technology- Dr. Abdollah Homaifar, Director (College of Engineering)**

  The areas of concentration are soft computing, multi agent 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 dynamical systems, artificial potential field based motion planning/navigation in two- and three-dimensional dynamic environments, and other relevant topics.

For more information, call (336) 334-7761.

- **Center for Composite Material Research- Dr. Kunigal Shivakumar, Director (College of Engineering)**

  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 processing and fabrication of simple to complex composite components (autoclave, compression molding, resin transfer molding, and composite structural components); use of textile fiber architectures in the fabrication of non-trivial light weight composite components (braids, plain weaves, etc.); testing and characterization of composite materials; analysis of composite structural components; study of cost-effective near net-shaped composite components; development of innovative processing techniques with textile fabrics (small ablative nozzles, integrally blade-stiffened panels, box sections, etc.); and training of students and engineers from industry in the fabrication and use of composites.

For more information, visit http://www.ncat.edu/~ccmradm/ccmr or call (336) 334-7411 Ext. 2111

- **Center for Cooperative Systems- Dr. Bikdash, Director (College of Engineering)**

The mission of the Center for Cooperative Systems is to conduct research focused on the modeling, monitoring, control, and operation of a large number of agents or subsystems that can operate at various levels of autonomy, adaptation, intelligence, and cooperation. Examples of such systems include robotic systems which collaborate with human operators, social networks, sensor networks, and infrastructure networks populated by humans and autonomous systems.

The Center's research is multi-disciplinary and draws on the expertise of several faculty and students. Disciplines involved include: formation flying of collaborating spacecraft; pattern recognition form acoustical and seismic sensors; computational modeling of networks of social agents; reduced-order modeling of the diffusion of influence over networks; control, collaboration and decision making via large information systems such as the internet or geographic information systems; evolution of behavior in populations under various levels of competition; and survivable networks.

- **Center for Energy Research & Technology- Dr. Harmohindar Singh, Director (College of Engineering)**

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.

For more information, visit http://cert.ncat.edu/ or call (336) 334-3566.

- **Center for Human Machine Studies- Dr. Celestine Ntuen, Director (College of Engineering)**

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.

For more information, visit http://gandalf.ncat.edu/ihms or call (336) 334-7780.

- **Interdisciplinary Center for Entrepreneurship & E-Business – Dr. Thaddeus McEwen, Director (School of 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, increase student participation in e-business, provides an entrepreneurial environment and opportunities for students to successfully start their entrepreneurial careers, and 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.

For more information, visit http://www.ncat.edu/~iceeb or call (336) 334-7656.

- **International Trade Center- Dr. Osei Yeboah, Director (School of Agriculture)**

  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 developing educational programs to enable farmers and processors to produce a broader range of products to boost local economic performance; identifying alternative markets; enhancing understanding of the linkages among national economies, world markets, and agriculture; conducting market-based research to understand factors that influence competitiveness; educating producers, processors, and other clients about trade policies, regulations, and world economic and political trends affecting U.S. trade competitiveness; and developing programs of North Carolina's rural communities to enhance entrepreneurial skills, create jobs, and diversify their economies.

For more information, visit http://www.ag.ncat.edu/centers/int-trade/ or call (336) 334-7979.

- **Interdisciplinary Scientific Environmental Technology Cooperative Science Center (ISETCSC)**

  Center Director: Dr. Solomon Bililign (College of Arts & Sciences)
  Deputy Director: Dr. Keith Schimmel
  Senior Scienctist: Dr. Yuh-Lang Lin
  Associate Director: Ms. Jessica Bohn

  ISETCSC is an education and research Center led by North Carolina Agricultural and Technical State University in collaboration with six universities: City University of New York, North Carolina State University, California State University-Fresno, University of Alaska Southeast, Fisk University and University of Minnesota. ISETCSC brings together researchers and educators from engineering, physical sciences, and social sciences to train underrepresented students through high-level research participation to produce interdisciplinary professionals that can provide critical support for NOAA’s mission.

  ISETCSC’s educational goals are achieved primarily by student participation in high-quality interdisciplinary research, thereby relating classroom knowledge to real-life technological applications. ISETCSC pursues a holistic approach that integrates classroom learning with research experience. ISETCSC Goals are:

1. Educate, train, and sustain a world-class workforce that reflects the nation's diversity and is skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission.

2. Conduct collaborative research that involves NOAA scientists across line offices, work closely with OAR and the future Climate Service, engage underrepresented students, to meet the objectives of developing:
(a) Meteorological, oceanographic and chemical sensors.
(b) Improved modeling tools and algorithms for analyzing data from global observing systems to help understand weather, climate, and environmental change.
(c) Information technology tools for data assimilation, fusion, and mining.

3. Implement a community-oriented approach to understand, identify, and respond to the science and technology background needed by the government and business communities to address climate, weather, air quality, and environmental issues to government, businesses, and communities.

More information on ISETCSC is available at www.noaaiset.org.

- **Center for Aviation Safety- Dr. Kunigal Shivakumar, Director (College of Engineering)**

The vision of the Center for Aviation Safety (CAS) is to establish a strong aerospace engineering research and education program by bringing together highly competent and dedicated faculty members at North Carolina A&T State University (A&T) through the support of NASA funding to address the challenges of Aeronautics Research Mission Directorate's Fundamental Aeronautics and Aviation Safety Programs. The research goal of the CAS is through an understanding of science and engineering to develop materials, tools, models, and technologies that support the safe operation of aerospace vehicles. Research objectives are: Advancing Composites and Structures; Integrating Vehicle Health Management; and Advancing Aeromechanics and propulsion. The educational objective is to produce high quality engineers and scientists to support the aerospace programs of the country and to attract future students through outreach activities. The CAS will accomplish the stated goals through partnership with NASA (Dryden, GRC, & LaRC), major aerospace industries, academic advisors, and small business. The CAS uses current research facilities and synergetic research activities of the team to quickly start-off and become productive with the new NASA funds. After 2-3 years of research performance and partnership building, CAS will be able to solicit additional funding and continue to grow well beyond the initial five years of NASA's funding.

For more information, email kunigal@ncat.edu or call (336) 334-7411 Ext. 2112.

- **Center for Excellence for Post Harvest Technologies**

The Center for Excellence in Post Harvest Technologies' (CEPHT) primary focus is to provide an infrastructure for multidisciplinary research programs for post harvest technology with focus on fruits and vegetables. CEPHT was established to play a lead role in using science to develop appropriate, need-based and cost-effective post harvest technology for North Carolina crops and to address related food sciences, nutrition and health issues. These include processing and preservation, storage stability, food safety and quality, composition, recovery and identification of bioactive compounds for health applications, product development, consumer research and value-added processing.

For more information, visit http://www.ag.ncat.edu/coepht/index.html or call (336) 256-1151.

- **NSF Engineering Research Center for Revolutionizing Biomaterials - Dr. Jag Sankar, Director (College of Engineering)**

  The ERC proposes to develop the fundamental knowledge and technology needed to advance biocompatible and biodegradable metal-based (especially Mg) implantable systems with feedback control for reconstruction and regeneration. The research and technology development will be aided by industrial input and clinical assessments supported by non-NSF funds. The ERC also will carry out an integrated educational program designed to attract students to engineering careers and to create innovative, adaptive engineers capable of continuing the development and application of implant technology. The ERC – Generation 3 will also focus on the global leadership and economic development of the nation.

THE DIVISION OF INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS

The Information Technology and Telecommunications division is organized into fifteen collaborative operating units and departments. The Office of the Vice Chancellor for ITT/CIO, the Office of the Chief ITT Architect, the Office of ITT Operations/CTO and its eight departments, and the Office of Teaching and Learning Technologies and its three departments.

1) **Office of the Vice Chancellor for ITT/CIO** – The Office of the Vice Chancellor for Information Technology and Telecommunications/Chief Information Officer is responsible for supporting and strengthening the University's learning, discovery, and engagement activities by providing the leadership and management guidance of central services and infrastructure characterized by operational excellence. All ITT operating units and departments report to this office.

2) **Office of the Associate Vice Chancellor for ITT/CTO** – The ITT Operations Unit is responsible for managing eight of the eleven ITT departments. These departments plan, install, monitor and support the University's information technology and telecommunications infrastructure. The ITT Operations cluster is led by the Associate Vice Chancellor for ITT/Chief Technology Officer. The eight departments that report to the ITT Operations Unit are managed by directors.

a. **Administrative Information Systems (AIS)** – AIS provides software development, project management, and application software technical support for the systems that support administrative processes related to the mission critical functions of the University. The AIS vision is to develop and support a community of knowledge workers (students, teachers, researchers, staff and administrators). They focus on easy access to secure, reliable and timely data, retaining quality staff and partnering with others to provide technical leadership and effective solutions.

b. **Data Base Administration (DBA)** – The mission of the DBA department is to create and support databases for the University; and to ensure the highest possible level of database availability and performance. The DBA department supports databases for the Banner Project, the Resource 25 System, and the Residential Management System. In addition to database support, the DBA department also provides application support for the following systems: Resource 25, Residential Management, Aggie One Card, Web Focus, Telephone Reporting, Traffic, and the Library System.

A vital role of the DBA department is to perform database backup and recovery, database monitoring, and database tuning. The department also provides database consultation and assistance as needed.

c. **Converged Networks (CN)** – CN has the responsibility to provide the networking infrastructure and services that will enable the integration of data, voice and video on the University network. Convergence will require a complete migration of the infrastructure to enable this integration.

New Cisco centric hardware and network management software are being purchased to enable this convergence. CNS has also been charged with providing Distance Learning Technical Support for the University.

CNS also provides streaming media support for WNAA and the Aggie TV Studios as well as several on-line classes.

Converged Network Video Service has enabled the University to experience new opportunities by utilizing the power of information technology to create, support, and manage physical and intellectual resources. By utilizing a combination of microwave, H.320, H.323, MPEG, streaming, and emerging technologies NC A&T State University is now in the position to deliver distance learning programs to anywhere in the world.

The Converged Telecommunications Services department is responsible for managing all voice services and voice related applications for the University, faculty, staff, and student populations. The mission of Telecommunication Services is to provide effective and efficient voice products and services to NC A&T State University.

d. **Research Computing, Academic Labs, Student Technology Services (STS)** – The goal of Research Computing is to establish a research infrastructure that maximizes and leverages the usage and deployment of computer hardware and software at the university.

   Academic Labs exists to maintain and provide a productive accessible environment for students (and faculty) to accomplish their work.

   Student Technical Services (STS) provides a student run organization that supplies student resources to technical areas around campus to enhance the student learning and to supply critical resources that supplement existing ITT employees and non-student workers.

e. **Security and Audits (SA)** – The mission of IT Security and Audits is to provide guidance relevant to making information technology resources accessible for appropriate academic and administrative purposes, yet secure from inappropriate intrusion or usage. This will be achieved by engaging the campus community in security education and end user audit compliance with university policies. This department monitors adherence to federal and state legislation regarding information technology.

f. **Special Projects and Programs (SPP)** – SPP provides support for the Division of Business and Finance, Financial Records Systems (FRS) and other special projects Programs as they arise. FRS is a critical part of the SCT-centric ERP system.

g. **Systems and Support (SS)** – is responsible for the technical support of the ITT infrastructure: back office systems, storage and computing systems configurations, maintenance, performance, and general operations.

   Systems and Support provides consulting services and information technology support to University faculty, staff, students, and external stakeholders. The Aggie Help Desk is the centralized point of contact for initiating or receiving status updates and requests. The Aggie Help Desk coordinates the support and services provided by all departments in the Division of Information Technology and Telecommunications.

h. **The Department of Web Support Services (WSS)** – The WSS department was created to provide support for the development, implementation and maintenance of the front-end portal and web interface for the ITT infrastructure. WSS is responsible for establishing website and portal policies, processes, procedures and standards for assisting the campus learning community with website management and development for publication, communication and collaboration. WSS communicates information on courses of study, faculty and student research, schedule of activities and outreach programs to potential students, researchers, corporate partners and other visitors. WSS also provide support for Internet, Intranet and Extranet design to facilitate such activities as post grades, course schedules, lesson plans, and other documentation critical for students, faculty and staff web-based learning, discover and engage.

3) **Office of the Assistant Vice Chancellor for ITT and Chief ITT Architect** – The chief ITT architect is responsible for the overall architectural design and coordination of the consolidated ITT infrastructure. This office is responsible for coordinating technology design and development plans for all departments in the Division of ITT,

throughout the University and with external groups to ensure that the campus infrastructure is developed and implemented using a consistent, comprehensive set of guiding technology principles and standards.

4) **Office of the Assistant Vice Chancellor for Teaching and Learning Systems (TLT)** – The mission of Teaching and Learning Technology is to develop, deploy and manage the infrastructure and curriculum for delivering technology proficiency and professional development competencies of the University community including students, faculty, and staff. TLT also engages in community-based initiatives addressing the "digital divide."

TLT is responsible for developing information systems to enhance technological proficiency across the campus. The department assists the Academy for Teaching and Learning, and faculty with integrating technology, pedagogy and assessment into instruction. TLT also assists the learner-centered community by providing workshops and seminars to enhance their productivity and effective utilization of campus technology resource. TLT assists students by helping them become acclimated to the campus computing environment and increasing their awareness of various technology support services.

a. **Center for Distance Learning –** The Center for Distance Learning offers both traditional and non-traditional students the opportunity to obtain an education through the online and extension modes of learning. Courses offered online are delivered through the Internet. The University offered its first online courses during the fall 1999 semester. The Center for Distance Learning was established in March 2000 to help promote substantial enhancements in the quality of educational programming available to non-traditional students.

b. **ITT-Administrative Services Department –** The administrative services department inures accountability and compliance with university/state policies and procedures related to telephonic and wireless services, processing of service providers billing, maintaining accurate records for all university departments related to these services. This department is also responsible for providing internal customer services by processing requests by the end users and resolving any issues related to the services. This department is also responsible for processing all internal requests for purchases, invoice processing to accounting department, statistical reporting, financial reporting, budget analyst, departmental liaison with all administrative departments, colleges and schools of this university for EDP equipment, software, and telecommunications equipment.

c. **e-Learning Department** – The e-Learning department provides instruction and support for the software delivery of online learning. The e-Learning department responsibilities include developing information systems training materials to enhance technology proficiency across the campus and conducting workshops and seminars to enhance the faculty and staff productivity by effective utilization of the campus technology.

MAJOR 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. 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. Computational Science and Engineering
2. Electrical Engineering
3. Energy and Environmental Systems (General)
4. Energy and Environmental Systems (Atmospheric Sciences)
5. Energy and Environmental Systems (Sustainable Bio Products)

6. Energy and Environmental Systems (Energy and Environmental Sciences and Economics)
7. Industrial Engineering
8. Leadership Studies
9. Mechanical Engineering
10. Technology 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 (K—12) (MAT)
3. Physical Education, Teaching Track
4. Physical Education, Non-Teaching Track

College of Arts and Sciences (MAT)

1. Biology Education
2. Chemistry Education
3. English Education
4. History Education
5. Mathematics Education

School of Business and Economics (MAT)

1. Business Education

School of Agriculture and Environmental Sciences (MAT)

1. Child Development, Early Education and Family Studies Birth – Kindergarten
2. Family and Consumer Sciences

School of Technology

1. Technology Education(9-12)
2. Trade and Industrial Education 9-12
3. Training and Development for Industry

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 (Professional Licensure)
c. Agricultural Education (Professional Service)

2. Animal Health Science
3. Food and Nutritional Science
4. Plant and Soil Science

College of Arts and Sciences

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

School of Education

1. Adult Education
2. School Counseling
3. Elementary Education (k-6)
4. Physical Education (k-12)
5. Community Counseling
6. Rehabilitation Counseling
7. Instructional Technology, Teaching Track
8. Instructional Technology, Business and Industry Track

College of Engineering

1. **Bioengineering**
2. Civil Engineering
3. Chemical Engineering
4. Computational Science and Engineering
5. Computer Science
6. Electrical Engineering
7. Industrial Engineering
8. Mechanical Engineering

School of Technology

1. Construction Management and Occupational Safety and Health
    a. Technology Management (Construction Management)
    b. Technology Management (Environmental and Occupational Safety and Health)
2. Electronics and Computer Technology
    a. Technology Management (Electronics & Computer) (MSTM)
    b. Technology Management (Information Technology) (MSTM)
    c. Information Technology (MS)
3. Graphic Communication Systems and Technological Studies
    a. Technology Management (Graphic Concentration)
    b. Technology Education (Technology Education, Teaching)
    c. Technology Education (Trade and Industrial Education)
    d. Technology Education(Training and Development for Industry)
    e. Technology Education (Workforce Development Director)

4. Manufacturing Systems
    a. Technology Management (Manufacturing Systems)
    b. Technology Management (Construction Management)
    c. Technology Management (Occupational Safety and Health)
    d. Technology Management (Graphic Communication Systems)

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

School of Business and Economics

1. Human Resources Management
2. Management Information Systems
3. Supply Change Management

MASTER OF SOCIAL WORK (MSW) JOINT PROGRAM WITH UNC-G

College of Arts and Sciences

1. Social Work

POST MASTER'S CERTIFICATE PROGRAMS (P.M.)

1. Marriage and Family
2. Rehabilitation Counseling and Behavioral Addiction
3. School Administration
4. Vocational Education and Work Adjustment

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 (ie. Animal Science, Horticulture, Soil Science, Environmental Science),and 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:
Students can complete of a minimum of 30 semester credit hours, including 15 semester hours of "core" courses made up of 6 semester hours of advanced economic theory, 3 semester hours of agricultural economics/agribusiness applications, and 6 semester hours of quantitative methods; 6 semester hours of courses in the selected program track; 1elective 3-hour course, and 6 semester hours of thesis culminating in scholarly research work. In addition, the successful completion and defense of the thesis is required.

2. NON-THESIS OPTION – 33 Hours:

This option consists of a minimum of 33 semester hours, including 15 semester hours of "core" courses made up of 6 semester hours of advanced economic theory, 3 semester hours of agricultural economics/agribusiness applications, and 6 semester hours of quantitative methods; 9 semester hours of courses in the selected program track**;** 6 semester hours of elective courses, and 3 semester hours of a scientific paper. This non-thesis option recognizes the changes within the agricultural economics/agribusiness 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 issue-based project.

Students in both options are required to take a comprehensive examination in microeconomic theory and statistics. The student pursuing the Master of Science degree in Agricultural Economics is required to complete a common core of courses consisting of:

AGEC 705	Statistical Methods for Agricultural Economics	3 Semester Hours
AGEC 725	Research Methods in Agricultural Economics	3 Semester Hours
Or		
AGED 703	Scientific Methods in Research	3 Semester Hours
AGEC 710	Advanced Microeconomic Theory	3 Semester Hours
AGEC 720	Advanced Macroeconomic Theory	3 Semester Hours
AGEC 756	Agricultural Marketing and Price Analysis	3 Semester Hours
or		
AGEC 640	Agribusiness Management	3 Semester Hours

Core Courses Total **15 Semester Hours**

In addition, the student has a choice of two program tracks in either thesis or non-thesis options as outlined below:

Program Track: Agribusiness and International Trade

Thesis Option

AGRI 799 (Thesis)	6 Semester Hours
Program Track	6 Semester Hours
Elective	3 Semester Hours

Total Program Hours ***30 Semester Hours***

Non-Thesis Option

AGED 750 (Scientific Paper)	3 Semester Hours
Program Track	9 Semester Hours
Electives	6 Semester Hours

Total Program Hours ***33 Semester Hours***

Program track courses should be selected from the following lists:

AGEC 634	International Agribusiness Marketing	3 Semester Hours
AGEC 734	Agricultural Marketing and Interregional Trade	3 Semester Hours
AGEC 738	International Agricultural Trade and Policy	3 Semester Hours
AGEC 736	Agribusiness Finance and Marketing Management	3 Semester Hours

Program Track: Rural Development Policy

Thesis Option

AGRI 799 (Thesis)	6 Semester Hours
Program Track	6 Semester Hours
Elective	3 Semester Hours

Total Program Hours ***30 Semester Hours***

Non-Thesis Option

AGED 750 (Scientific Paper)	3 Semester Hours
Program Track	9 Semester Hours
Electives	6 Semester Hours

Total Program Hours ***33 Semester Hours***

Program track courses should be selected from the following courses:

AGEC 632	Food and Agricultural Policy	3 Semester Hours
AGEC 732	Environmental Economics and Policy	3 Semester Hours
AGEC 708	Econometrics	3 Semester Hours
AGEC 735	Economic Development	3 Semester Hours
AGEC 760	Social Organization of Agriculture and Rural Development	3 Semester Hours
AGEC 740	Production Economics	3 Semester Hours

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:

AGEC 705	**Advanced Statistics**	**3 Semester Hours**
Or		
CUIN 710	**Educational Statistics**	**3 Semester Hours**
AGEC 725	**Research Methods**	**3 Semester Hours**
Or		
AGED 703	**Scientific Methods in Research**	**3 Semester Hours**

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
AGEC 632	Food and Agricultural Policy	3
AGEC 634	International Agribusiness Marketing	3
AGEC 638	Special Problems in Agricultural Economics	3
AGEC 640	Agribusiness Management	3
AGEC 641	Special Problems in Agribusiness Management	3
AGEC 648	Appraisal and Finance of Agribusiness Firms	3
AGEC 675	Computer Applications in Agriculture	3
AGEC 705	Statistical Methods for Agricultural Economics	3
AGEC 708	Econometrics	3
AGEC 710	Advanced Microeconomic Theory	3
AGEC 720	Advanced Macroeconomic Theory	3
AGEC 725	Research Methods in Agricultural Economics	3
AGEC 732	Environmental Economics and Policy	3
AGEC 734	Agricultural Marketing and Interregional Trade	3
AGEC 735	Economic Development	3
AGEC 760	Social Organization of Agriculture and Rural Dev;	3
AGEC 736	Agribusiness Finance and Marketing Management	3
AGEC 738	International Agricultural Trade and Policy	3
AGEC 740	Production Economics	3
AGEC 756	Agricultural Marketing and Price Analysis	3
AGEC-760	Social Organization of Agriculture and Rural Development	3

AGRI 799	Thesis Research	6
AGRI 999	Continuation of Thesis	1

COURSES DESCRIPTIONS IN AGRICULTURAL ECONOMICS

Advanced Undergraduate and Graduate

Agricultural Economics

AGEC-632 Food and Agricultural Policy Credit 3(3-0)
Principles of agricultural and food policy formulation; agricultural adjustment processes; agricultural price and income policies in relation to land use, water, and rural development policies; interelationships among U.S. and foreign agriculture and trade policies (S)

AGEC 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 (F)

AGEC 638 Special Problems in Agricultural Economics Credit 3(3-0)
This course is designed for students who desire to work out special problems in the field of agricultural economics; problem definition, formulation and investigation will be emphasized. Prerequisite: Consent of the department chairperson (F)

AGEC 640 Agribusiness Management Credit 3 (3-0)
This course emphasizes decision-making of agribusiness managers, agribusiness management consultants, and entrepreneurs of agriculturally related firms. Contemporary topics facing the agribusiness decision-maker such as how to establish an agriculturally based firm, marketing agribusiness firms through E-Commerce, examining food supply chains, establishing contractual agreements with other firms, and evaluating industrial organization within the agribusiness industry are presented. Students are expected to simulate the decision-making of the agribusiness manager/entrepreneur through the use of case studies, agribusiness projects, agribusiness research, and business plans.

AGEC 641 Special Problems in Agribusiness Management Credit 3(3-0)
This course relies heavily on the "Harvard Case Studies Approach" to 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 AGEC 640 or consent of instructor (DEMAND)

AGEC-642 Seminar in Agricultural Economics Credit 3(3-0)
Discussion of reports and an appraisal of current literature on agricultural problems will take place. Prerequisite: Consent of the Department Chairperson. **(DEMAND)**

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 (DEMAND)

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 analyses of farm and agribusiness-related problems. Prerequisites: AGEC 330, or ECON 300. **(S).**

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.

AGED -620. Rural Communities and Leadership **Credit 3 (3-0)**
This course will focus upon the importance of grassroots leadership development within the context of rural community settings.

Graduate Students Only

Agricultural Economics

AGEC- 705 Statistical Methods for Agricultural Economics **Credit 3(3-0)**
Advanced topics on analysis of variance, regression, correlation, multistage sampling and probability are covered in depth. Prerequisite: AGEC 406

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 Advanced Microeconomic Theory **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 Advanced Macroeconomic Theory 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 Environmental Economics and Policy Credit 3 (3-0)

Interrelationships of natural resource use and the environment; applied welfare and benefit-cost analysis; externalities and pollution abatement; non-market valuation of resources; property rights; legal and social constraints; policy approaches.

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 rational 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. 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 discussed.

AGEC 736 Agribusiness Finance and Marketing Management Credit 3 (3-0)

This course emphasizes the analysis of financial institutions and financial markets and policy issues of financial intermediaries of entrepreneurs, managers, or consultants of agriculturally related firms. Emphasis is placed on the analysis and problem solving faced by the agribusiness decision-maker. Case studies, research articles, and simulation games are used. (S)

AGEC 738 International Agricultural Trade and Policy Credit 3 (3-0)

The course is intended to convey basic economic principles underlying decision making and policy formulation related to international trade. The course is designed to introduce students to basic theories of international trade, and help them apply these principles to agricultural trade practices.

AGEC 740 Production Economics Credit 3 (3-0)

This course focuses specifically on production economics theory in 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 Marketing and 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.

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 Research Credit 6 (6-0)

AGRI 999 Continuation of Thesis Credit 1(1-0)

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

This course covers a study of the common problems of the community that relate to agriculture and related areas and of solutions for these problems.

<u>Agricultural Education</u>

AGED-700 Advanced Competencies and Portfolio Development Credit 1 (1-0)

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

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 additional 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.

DIRECTORY OF FACULTY

Kofi Adu-Nyako . . . . **Adjunct Associate Professor**
B.S., University of Science and Technology; M.S., Cornell University; Ph.D., University of Florida
Antoine J. Alston . . . . **Professor**
B.S., M.S., North Carolina A&T State University; Ph.D., Iowa State University

Godfrey C. Ejimakor……………………………………………………………………………………… **Professor**
B.S., North Carolina State University; M.S., North Carolina A&T State University; Ph.D., Texas Tech
Paula E. Faulkner ……...**Assistant Professor**
B.S., M.S., North Carolina A&T State University, Ph.D. The Pennsylvania State University
Benjamin Gray . . . .……… **Associate Professor**
B.S., M.S. North Carolina A&T State University, Ph.D., North Carolina State University
Kenrett Y. Jefferson-Moore………………………………………………………………………. **Associate Professor**
B.S. Southern University, M.S. Alabama A&M University, Ph.D. Auburn University
Daniel M. Lyons . . . . **Cooperative Extension Faculty, Administration**
B.S., M.S., North Carolina A&T State University; Ed.D., Virginia Polytechnic Institute and State University
Donald R. McDowell………………………………...**Professor and Interim Dean**
B.S., Southern University A&M; M.S., Ph.D., University of Illinois
John O'Sullivan . . . . **Cooperative Extension Faculty**
B.A., Stanford University; M.S., Auburn University; Ph.D., University of California at Los Angeles
John P. Owens . . . . **Adjunct Instructor**
B.S. Appalachian State University, M.S. North Carolina A&T State University
Richard D. Robbins . . . . **Professor**
B.S., North Carolina A&T State University; M.S., Ph.D., North Carolina State University
Terrence Thomas………………………………………………………………... …………**Associate Professor**
B.S., University of West Indies; M.S., University of Wisconsin; Ph.D., Louisiana State University
Chastity Warren English . . . . **Assistant Professor**
B.S., M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University
Anthony K. Yeboah…………………………………………………………………**Professor and Chairperson**
B.S., University of Science and Technology; M.S., Ph.D., Iowa State University
Osei-Agyeman Yeboah……………………………………………………………................**Associate Professor**
B.S. University of Science and Technology, Kumasi, Ghana, M.S. North Carolina A&T State University; Ph.D. University of Nebraska

Animal Sciences

Ralph C. Noble, 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)
ANSC 703	Disease Management of Livestock and Poultry	3 (3-0)
AGRI 799	MS Thesis Research	6 (6-0)
AGRI 604	Research Design and Analysis	3 (2-2)
	Elective Courses:	
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 665	Techniques in Biotechnology	3 (2-2)
ANSC 708	Special Problems in Animal Health	2 (2-0)
ANSC 712	Nutrition and Disease	3 (3-0)
ANSC 713	Global Livestock Systems	3 (2-2)
ANSC 723	Animal Physiology	3 (3-0)
ANSC 771	Bioinformatics and Design Analysis	3 (3-0)
ANSC 782	Cellular Pathobiology	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-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.

<u>GRADUATE STUDENTS ONLY</u>

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 703. Disease Management of Livestock and Poultry **Credit 3 (3-0)**
This course covers practices and procedures for disease control in livestock species and poultry. Emphasis is placed on micro and macroenvironments that result in disease.
Prerequisite: ANSC 212, ANSC 451 or permission of instructor.

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)**

Directory of Faculty

Fultz, Doris G., B.S., 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
Minor, Radiah Corn, B.S., Florida A&M University; Ph.D., Meharry Medical College, Assistant 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
Miller, John H., B.S., Elon College; M.S., North Carolina A&T State University; Ph.D., Virginia Tech; Extension Specialist
Noble, Ralph C., B.S., M.S., Tuskegee University; Ph.D., University of Illinois-Champaign-Urbana; Associate Professor and Chairperson
Oh, Sang-Hyon, B.S., M.S., Seoul National University; Ph.D., North Carolina State University; Adjunct Assistant Professor
Waterman, Jenora, B.S., Bennett College for Women; M.S., North Carolina A&T State University; Ph.D., North Carolina State University; Assistant Professor
Willis, Willie, B.S., Fort Valley State University; M.S., Ph.D., Colorado State University; Professor
Woldeghebriel, Abraham, B.S., Addis Ababa University; M.S., Ph.D., New Mexico State University; Associate Professor
Worku, Mulumebet, B.Sc., Addis Ababa University, Alemaya College of Agriculture, Ethiopia; M.S., Ph.D., University of Maryland, College Park; Professor

Mary A. Smith, Chairperson
Doretha B. Foushee, Associate Chairperson

OBJECTIVES

The Department's primary objective for the Master of Science degree program is to prepare students to enter and complete doctoral and health professional programs in order to become productive teachers, researchers, and health professionals. To support this 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 12 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)
(33 semester hours, including master's project. Fifty percent of the accumulated hours **must** be at or above the 700 level.)

Master of Art in Teaching
(36 semester hours organized into two phases: Phase I - Licensure (27 hours) and Phase II - Advanced Studies (15 hours))

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, and Biochemistry, one year of calculus, one year of physics (calculus-based physics is preferred) and courses in genetics and 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.

Application deadlines for fall and spring semester admissions are June 1st 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 749 (Recent Advances in Cell Biology, 3 semester hours)
2. BIOL 785 (Writing for the Biological Scientist, 3 semester hours)
3. BIOL 701, 702 (Biological Seminar, 2 semester hours)
4. BIOL 681/CSE 701 (Application Probability and Statistics, 3 semester hours)
5. CHEM 651, 652 (Biochemistry, 5 semester hours)
6. BIOL 862, 863 (Thesis Research, 6 semester hours)

7. Complete a minimum of 5 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.
8. Maintain a 3.0 grade point average.
9. Attend all Departmental Seminars and journal club meetings.
10. Have at least one academic year of residence at A&T.
11. 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).
12. Satisfactorily present and defend the thesis.

MASTER OF SCIENCE IN BIOLOGY (NON-THESIS OPTION)

1. BIOL 749 (Recent Advances in Cell Biology, 3 semester hours)
2. BIOL 785 (Writing for the Biological Scientist, 3 semester hours)
3. BIOL 701, 702 (Biological Seminar, 2 semester hours)
4. BIOL 682/CSE 701 Application Probability and Statistics, 3 semester hours)
5. CHEM 651, 652 (Biochemistry, 5 semester hours)
6. BIOL 703 (Experimental Methods Biology, 3 semester hours)
7. BIOL 712 (Master's Project, 6 semester hours)

8. Complete a minimum of 14 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.
9. Maintain a 3.0 grade point average.
10. Attend all Departmental Seminars.
11. Have at least one academic year of residence at A&T.
12. 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).
13. Satisfactorily complete and defend a Master's Project.

MASTER OF ARTS IN TEACHING: BIOLOGY EDUCATION

Situated within the School of Education's conceptual framework of "The Professional Educator: A Catalyst for Learning" the M.A.T. program is designed for college graduates who have decided to enter the teaching profession, many of whom will already be lateral entry teachers, teachers changing fields and prospective candidates who are taking coursework before entering the classroom. It is another way of addressing the critical teacher shortage, since post baccalaureate students accepted to this program will have the academic credentials and maturity necessary to complete both introductory and advanced work in teacher education in a graduate level program. The Master of Arts in Teaching will enable prospective teachers, who bring content knowledge to the graduate degree, the opportunity to develop the knowledge skills, and dispositions to become excellent teachers.

The M.A.T. program requires 39 hours of graduate study which is organized into two phases. The Phase I: Licensure (27 hrs) is open is open to M.A.T. candidates and non-candidates, seeking to obtain the initial “A” license. Phase II: Advanced Studies (15 hrs) includes the required courses needed to earn the M.A.T. degree and the advanced “M” licensure. The Phase 1: Licensure admission requirements include 1) a Bachelor’s Degree in Biology or related discipline from an accredited institution, 1) completion of any required pre-requisite course and 3) an undergraduate GPA of 2.5 or better and passing scores on Praxis I: To be admitted to Phase II: Advanced Studies, candidates must 1) complete Phase I coursework with a GPA of 3.0 or better, and 2) earn passing scores on Praxis II and Class A licensure. The coursework for Phase I and II are as follows:

- Phase I courses include 15 hours in education CUIN 618, CUIN 729, CUIN 715, CUIN 627, CUIN 660), 6 hours in biology (BIOL 722, BIOL 723) and 6 hours in secondary science teaching and internship (BIOL 635 or 640 Methods of Teaching for 21st Cen..
- Benchmarks include 1) passed Praxis II exam, 2) earned A licensure 3) GRE or MAT scores, and 4) teaching portfolio
- Phase II courses include 1) 6 hours in education (CUIN 711, CUIN 728,) and 6hours in biology (BIOL 600 level or above) and a Graduate Project Course

LIST OF GRADUATE COURSES

Course	Title	Credits (lec-lab)
BIOL 615	Principles of Virology	3 (3-0)
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 681	Statistical Methods for Research	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 710	Introduction to Research in the Biological Sciences	3 (3-0)
BIOL 712	Master’s Project	3 (0-12)
BIOL 720	Environmental Influences on Human Diseases	3 (3-0)
BIOL 749	Recent Advances in Cell Biology	3 (3-0)
BIOL 750	Microscopy Technique	3 (1-4)
BIOL 755	Systems Biology	3 (3-0)
BIOL 759	Experimental Developmental Biology	3 (1-4)
BIOL 762	Molecular Pathogenesis of Cancer	4 (4-0)
BIOL 785	Writing for the Biological Scientist	3 (3-0)
BIOL 788	Comprehensive Examination	0 (0-0)
BIOL 862	Biology Thesis I	3 (0-12)
BIOL 863	Biology Thesis II	3 (0-12)

COURSE DESCRIPTIONS IN BIOLOGY
Advanced Undergraduate and Graduate Courses

BIOL-615. Principles of Virology **Credit 3 (3-0)**

This course is a study of viruses and their effects on living organisms. Special emphasis will be placed on virus structure and classification, virus replication, viruses that infect bacteria, plants, and humans, the contribution of viruses to the development of immunology, biotechnology, and other areas of science, and the role of viruses in evolution, the development of cancer, and bioterrorism.

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-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.

BIOL 681. Statistical Methods for Research **Credit 3 (3-0)**
Introductory statistical methods for biological research including: descriptive statistics, probability distributions (binomial, normal student's t-distribution), parametric and non-parametric hypothesis tests, confidence intervals, chi-square tests/contingency table analysis, introduction to one-way ANOVA, and bivariate regression. Laboratory exercises will provide the student with experience using statistical software packages for data analysis. Prerequisites: MATH 224 or 231. **(F,S)**

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-710. Introduction to Research in the Biological Sciences **Credit 3 (3-0)**
This course is designed to provide graduate students the foundation needed to successfully design and implement their thesis research. Each student will focus on understanding the literature, the techniques, and the equipment that will be used to complete his/her thesis research.

BIOL-712. Master's Project **Credit 3 (0-12)**
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-720. Environmental Influences on Human Diseases **Credit 3 (3-0)**
The purpose of this course is to discuss the role that environmental toxicants play on human health. This course will discuss reports from scientific research journals that investigate the relationship of environmental toxicology to human pathology. The students will report on and discuss current events and media reports that describe diseases with environmentally-influenced causations.

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-755. Systems Biology **Credit 3 (3-0)**
This is an advanced graduate level course designed to present recent trends on the systematic study of complex interactions in biological systems, and how these interactions give rise to function and behavior of the biological system. Genomics, transcriptomics, protemomics, cytomics, RNA interference, and relevant bioinformatics concepts and applications will be studied. The course will also focus on how high through put data is analyzed, integrated and applied to the understanding of complex biological systems.

BIOL-762. Molecular Pathogenesis of Cancer **Credit 4 (4-0)**
This couse examines pathobiological features of cancer. An interdisciplinary approach will be utilized that will draw from epidemiology, genetics, molecular biology, and clinical medicine to investigate cancer etiology, pathogenesis, prevention, and treatment. Students in this course will also be required to develop innovative supplemental instruction for undergraduate students taking a concurrent course. Students in this course will also be required to present oral presentations based on cancer literature during departmental journal club.

BIOL-785. Writing for the Biological Scientist **Credit 3 (3-0)**
This is an advanced graduate level course designed to allow graduate students in the biological sciences to develop proficiency in writing scientific manuscripts and research proposals following the National Institutes of Health, National Science Foundation, and other federal agency guidelines. Students will improve their ability to read and understand scientific journal articles, ask questions, develop clear hypotheses about issues for which there is no answer in the literature, design experiments to test hypotheses and present them very clearly and concisely in writing.

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 (0-12)**
Master's level research in biology. Prerequisite: Consent of advisor.

BIOL-863. Biology Thesis II **Credit 3 (0-12)**
Master's level research in biology. Prerequisites: Biology 862 and consent of advisor.

Directory of Faculty

David W. Aldridge ………………..**Professor and Interim Dean of the College of Arts & Sciences**
B.S., M.A University of Texas, Arlington; Ph.D., Syracuse University; Postdoctoral, Woods Hole Marine Biological Laboratories
Goldie S. Byrd …………………………………………………….**Nathan Simms Endowed Professor**
B.S., North Carolina A&T State University; Ph.D., Meharry Medical College; Post-doctoral, Meharry Medical College
Roy Coomans ……………………………………………………………………..**Associate Professor**
B.S., Eckerd College; Ph.D., University of North Carolina-Chapel Hill
Doretha B. Foushee …………………………………………**Associate Professor and Associate Chairperson**
B.S., Shaw University; M.S., North Carolina Central University; Ph.D., University of Maryland at College Park
Andrew G. Goliszek ……………………………………………………………… **Associate Professor**
B.S., University of West Florida; M.S., Ph.D., Utah State University; Postdoctoral, Wake Forest University
Randall Hayes……………………………………………………………………………..Assistant Professor
B.S., University of Kentucky, Lexington; Ph.D., University of Rochester
Jessica (Jian) Han…………………………………………………………………….Assistant Professor
B.S., M.S., Nankai University; M.S.,University of Hawaii at Manoa; Ph.D., Pennsylvania State University
Vinaya A. Kelkar ………………………………………………………………**Research Assistant Professor**
B.S., Gujarat University – India; M.S., Old Dominion University; Ph.D., University of North Carolina at Greensboro
Patrick Martin ……………………. ……………………………………………………**Assistant Professor**
B.S., Virginia Union University; Ph.D., University of Virginia
Perpetua Muganda …………………………………………………………………..**Professor**
B.S., Lock Haven State College; M.S., Howard University; Ph.D., Indiana University School of Medicine

Elimelda M. Ongeri…………………………………………………………………….. …Assistant Professor
B.S., Egerton University; M.S., Purdue University; Ph.D., Purdue University

Checco Rorie ……………………………………………………………………………..**Assistant Professor**
B.S., Clark Atlanta University, Ph.D., University of North Carolina at Chapel Hill
Mary A. Smith …………………………………………………………**Associate Professor and Chairperson**
B.S., M.S. Morgan State University; Ph.D. Cornell University; Post-doctoral: Cornell University and Michigan State University
Catherine White ………………………………………………………………………….**Associate Professor**
B.S., Johnson C. Smith University; Ph.D., Wayne State University
Joseph J. Whittaker ……………………………………………………………………………**Associate Professor**
A.B., Talladega College; Ph.D., Meharry Medical College; Post-doctoral: Purdue University and Washington University

Business Education

Lisa G. Snyder, Interim Chairperson
Suite 324, Merrick Hall
(336) 334-7657
http://www.ncat.edu/~sbe/gradprog/art.html

OBJECTIVES

The Department of Business Education offers a program of study leading to the Master of Arts in Teaching—Business Education (MAT--BE). The Master of Arts in Teaching—Business Education Degree Program is designed for college graduates who have already earned a bachelor's degree in a business discipline and have decided to enter the teaching profession. Many already are lateral entry teachers or prospective teachers who are taking coursework before entering the classroom. The Master of Arts in Teaching—Business Education will enable candidates to bring content knowledge to the graduate degree, and have the opportunity to develop the knowledge, skills, and dispositions needed to become excellent teachers.

The MAT—BE program prepares candidates for careers in public education, as business educators. In addition, candidates seeking the Licensure-only Program may enroll in the Post-Baccalaureate Program and complete the courses needed.

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. The Business Education Programs are also accredited by AACSB International.

CAREER OPPORTUNITIES

The Master of Arts in Teaching—Business Education prepares candidates for positions as business educators in the secondary schools and middle schools (Grades 7—12). Candidates who already hold an undergraduate degree in a business discipline but do not already hold a teaching license in Business Education may complete Phase I of the program to earn the "A" license and complete Phase II to earn the master's degree and the "M" license.

DEGREE OFFERED

Master of Arts in Teaching—Business Education

PROGRAM REQUIREMENTS

Students with any undergraduate business major are encouraged to apply. The program is designed to serve those who have not already earned a teaching license in Business Education. The program is in two phases. Phase I completes the work needed to earn the "A" license in Business Education and must be completed before admission to Phase II, which completes the program of study for the master's degree and earns the "M" license. The program requires 39 semester hours, 21 of which are in Phase I and 18 in Phase II. There is a business education internship (3 credit hours) and a thesis requirement (3 credit hours) that are both in Phase I. Candidates without an undergraduate business degree cannot be admitted to this program.

Together with the completion of Phase I with a GPA of 3.0 or better, transition to Phase II of the program also requires a passing score on the Praxis II in Business Education (0100), a GRE score and letter(s) of recommendation. Formal admission to the Teacher Education Program is required after the candidate has completed 9 credit hours (Phase I) with a GPA of 3.0 or higher.

Phase I Courses (21 required credit hours)
All candidates pursuing the MAT—BE must complete the following Phase I courses:

Course Title	Credit
BUED 624—E-Commerce Design and Implementation	3
BUED 675—Instructional Methods in Business Education	3
BUED 682—Business Education Planning and Leadership	3
BUED 699—Internship in Business Teacher Education	3
CUIN 618—Learning Theories: Worldviews, Paradigms, and Practices for 21st Century Classrooms	3
CUIN 627—Literacy in the Content Areas	3
CUIN 729—Diversity Issues in K-12 Schools	3
TOTAL:	**21**

Phase II Courses (12 required credit hours)
All candidates completing Phase II of the MAT—BE must complete the following courses:

Course Title	Credit
CUIN 711—Research Design and Methodologies	3
CUIN 720—Curriculum and Instruction	3
CUIN 729—Diversity Issues in K-12 Schools	3

Elective Courses (6 elective credit hours)
While completing Phase II, all candidates must complete two business electives (6 credit hours) of the following electives: 6

Business Electives

Course Title	
BUAD 713—Business Applications Development	3
BUAD 716—Strategic Marketing	3
BUAD 718—Management & Organization Analysis	3
BUAD 719—Information Systems Planning and Design	3
BUAD 732—Training and Development	3

CAPSTONE
BUED 799—Thesis **-OR-** Project plus one of the following electives: 3

Project Electives

Course Title	
INST 733—Integrating Assistive Technology	3
CUIN 728—Integrating Technology	3
CUIN 742—Instructional Design	3
CUIN 762—Advanced Internet Use in Education	3
CUIN 763—Multimedia Development and Evaluation	3
Or One (1) Additional BUAD Elective from list above	
TOTAL	**18**

Admission Criteria

To be admitted to the MAT—BE (Phase I), candidates must have earned a bachelor's degree in a business discipline, have an undergraduate GPA of 2.5 or better or a passing score on the Praxis I, complete any required pre-requisites, and meet all other criteria set by the Graduate School. Admission to Phase II of the program requires completion of all Phase I courses with a GPA of 3.0 or higher, a passing score on the Praxis II (0100), filing for the "A" license, recommendation from the candidate's principal or three recommendations from other persons who know the candidate's interaction with children or adolescents, and a GRE or MAT score.

BUSINESS EDUCATION COURSES WITH DESCRIPTIONS

BUED 624. E-Commerce Design and Implementation **Credit 3 (3-0)**
This hands-on course focuses on the design and implementation of an e-business site on a live server. Emphasis is given to effective design of Web pages, particularly the data collection forms such as the order and credit forms and how they interface with other business systems. A final project requires students to demonstrate the efficiency of their designs to a panel of external evaluators. Prerequisites: BUED 334 or ECT 201 or approval of the chairperson. (F)

BUED 675. Instructional Methods in Business Education **Credit 3 (3-0)**
This course focuses on helping teacher candidates develop strategies for teaching and assessing business and information technology, including the development of units of instruction, lesson plans, enrichment materials and assessments for effective teaching at the secondary level. Provisions are made for observing and participating in teaching demonstrations. This course includes 60 hours of observation in a public school business classroom. Prerequisites: CUIN 102 & 301, 400; PSYC 320; BUED 339, 334, senior standing, and admission to the Teacher Education Program, or admission to the MAT—BE Program. (F, S)

BUED 682. Business Education Planning and Leadership **Credit 3 (3-0)**
This course focuses on the principles of effective planning, leadership and supervision of public school business education programs. It includes the foundations of career and technical education from the federal and state perspectives as well as major issues and trends in business education. (F, S)

BUED 699. Internship in Business Teacher Education **Credit 3 (1-4)**
This course places the teacher candidate in a secondary level business education classroom for a period not less than one semester. It includes purposefully observing instruction, planning lessons, delivering instruction, and assessing students as well as classroom and extra-curricular activities associated with the role of teacher in the public school. Prerequisites: Completion of BUED 675 and passing score in Praxis II. (*This course also requires that an application to complete the internship be filed with the Office of Student Teaching and Internships, School of Education by the deadline.)* (F, S)

Directory of Faculty

Sherrie D. Cannoy **Assistant Professor**
B.S., M.S. (Bus.Ed.), M.S. (IT Mgnt.), Ph.D., University of North Carolina at Greensboro

Betty F. Chapman **Assistant Professor**
B.S., Shaw University; M.B.A., North Carolina Central University; Ph.D., Virginia Polytechnic Institute and State University

Jorge Gaytan **Associate Professor**
B.B.A., Western Michigan University; M.B.A., The University of Texas at El Paso; Ed.D., The University of Texas at El Paso

Lisa E. Gueldenzoph **Associate Professor and Interim Chairperson**
B.S., Northern Michigan University; M.Ed., Ph.D., Bowling Green State University

Thelma M. King **Associate Professor and Coordinator, Business Teacher Education Program**
B.S., North Carolina A&T State University; M.S., University of North Carolina at Greensboro; Ph.D., Virginia Polytechnic Institute and State University

Ewuukgem Lomo-David **Associate Professor**
B.S., Mankato State University; M.Ed., Ed.D., University of Memphis

Beryl C. McEwen **Professor and Interim Associate Dean**
B.Ed., University of Technology, Jamaica; M.S., Ph.D., Southern Illinois University at Carbondale

Chemical and Bioengineering

Leonard Uitenham, Department Chairperson
http://www.eng.ncat.edu/dept/mcen/

GENERAL PROGRAM REQUIREMENTS

Chemical Engineering

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)

GENERALAND DEPARTMENTALADMISSION 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-bycase 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 705	Transport Phenomena I	3 (3-0)
CHEN 710	Transport Phenomena II	3 (3-0)

CHEN 715	Advanced Chemical Engineering Analysis	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 twelve 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 605	Biochemical Engineering	3 (3-0)
CHEN 608	Bioseparations Fundamentals	3 (3-0)
CHEN 615	Energy and Fuels Fundamentals	3 (3-0)
CHEN 618	Air Pollution Control	3 (3-0)
CHEN 622	Green Engineering Fundamentals	3 (3-0)
CHEN 625	Fundamentals of Food Process Engineering	3 (3-0)
CHEN 635	Process Scaleup and Design	3 (3-0)
CHEN 640	Computer-Aided Chemical 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 664	Advanced Nuclear Fluid Mechanics and Heat Transfer	3 (3-0)

CHEN 665	Fundamentals of Polymer Engineering	3 (3-0)
CHEN 666	Special Projects in Chemical Engineering	Var. 1-3
CHEN 670	Solids Processing and Particle Technology	3 (3-0)

Graduate Only Courses

CHEN 700	Advanced Process Control	3 (3-0)
CHEN 705	Transport Phenomena I	3 (3-0)
CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 715	Advanced Chemical Engineering Analysis	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)
CHEN 799	Continuation of Master's Thesis	1 (1-0)
3 (3-0)		

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

CHEN 605. Biochemical Engineering **Credits 3 (3-0)**
This course explores the use of living organisms or parts of them (e.g., enzymes) for the production of chemical or biological materials. The course emphasis is upon bioreactor design. Topics covered include enzyme kinetics and biocatalysts, microbial growth and product formation, immobilization of enzymes and whole cells, bioreactor scale-up and design of batch and continuous bioreactors, heat and mass transfer in bioreactors, bioproduct recovery, and bioprocess design and modeling. Students are required to complete a bioprocess design and a project on a topic of national and/or international significance.

CHEN 608. Bioseparations Fundamentals **Credits 3 (3-0)**
The course deals with fundamentals of bioseparation processes which are characterized as removal of insolubles, isolation of products, and 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.

CHEN 615. Energy and Fuels Fundamentals **Credits 3 (3-0)**
Topics important to the exploration, production and processing of fuels are covered. Types of fuels covered include fossil fuels, synfuels, and fuels from renewable resources, such as, wind, solar and biomass. Students learn about processing of fuels by distillation, refining, fermentation, catalytic reactions, and removal of undesirable by-products. The design of fuel processes includes emphasis on economic and environmental impact.

CHEN 618. Air Pollution Control **Credits 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. (Course is to be cross referenced with CIEN 618) Prerequisite: Senior standing in CHEN courses.

CHEN 622. Green Engineering Fundamentals **Credits 3 (3-0)**
The fundamental concepts in green engineering and their application through industrial ecology, risk assessment and life-cycle assessment methodologies are covered. Topics include green engineering at the macroscale (industrial sector), mesocale (unit operations), and microscale (molecular interactions). A detailed chemical process with

emphasis on preserving and improving environmental quality and including economic analysis will be designed and analyzed.

CHEN 625. Fundamentals of Food Process Engineering **Credits 3 (3-0)**
This course covers the fundamentals of food processing including food preparation operations, different food processes, food development, slurry flow, processing operations, microbiology and health hazards, diseases and medicines, and their effects on humans. Sources of future food supplies are discussed.

CHEN 635. Process Scaleup and Design **Credits 3 (3-0)**
The courses covers 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. Equipment design is stressed. Prerequisite: Senior standing in CHEN courses.

CHEN 640. Computer-Aided Chemical Process Design **Credits 3 (3-0)**
The selection and use of computer-aided models for chemical process equipment design are stressed. The results of increasingly complex equipment and thermodynamic models are compared using the ASPEN PLUS simulation package. Students interpret the interrelationships between design and process variables using computer simulation. Simulation of systems containing solids and electrolytes is covered. Students complete an independent computer-aided design project and make an in-class presentation. Optimization methods are used to determine the best design

CHEN 645. Environmental Remediation **Credits 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 CHEN courses.

CHEN 655. Nanostructured materials and Engineering Applications **Credits 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.

CHEN 660. Selected Topics in Chemical Engineering **Credits 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.

CHEN 664. Advanced Nuclear Fluid Mechanics and Heat Transfer **Credits 3 (3-0)**
This course presents advanced thermal hydraulic characteristics of power reactors, thermal design principles, reactor heat generation, transport equations for single phase flow & two-phase flow, thermal analysis of fuel elements, single phase fluid mechanics, single phase heat transfer, two phase flow dynamics, two phase heat transfer, single heated channels, steady state flow and heat transfer analysis.

CHEN 665. Fundamentals of polymer Engineering **Credits 3 (3-0)**
This course involves a treatment of engineering and technology of polymeric materials. Students learn about control of significant variables in polymer synthesis, and physical methods for characterization of molecular weight, morphology, rheology and mechanical behavior. Engineering applications include additives, blends and composites, natural polymers and fibers, thermoplastics, elastomers and thermosets, polymer degradation and stability, polymers in the environment, and polymers for advanced technologies, such as, membrane separations, biomedical devices, electronic and photonic industry.

CHEN 666. Special Projects in Chemical Engineering **Credits 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.

CHEN 670. Solids Processing and Particle Technology **Credits 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.

CHEN 700. Advanced Process Control **Credits 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.

CHEN 705. Transport Phenomena I **Credits 3 (3-0)**
This course presents a unified treatment of momentum, energy and mass transport with an emphasis on the microscopic approach. Students learn to develop and solve differential transport equations with defined boundary conditions, and apply this knowledge for solution of some simple chemical process problems.

CHEN 710. Transport Phenomena II **Credits 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.

CHEN 715. Advanced Chemical Engineering Analysis **Credits 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.

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

CHEN 730. Advanced Biochemical Engineering **Credits 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. 25

CHEN 740. Advanced Chemical Process Design **Credits 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.

CHEN 750. Separation Processes **Credits 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.

CHEN 760. Advanced Chemical Engineering Thermodynamics **Credits 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.

CHEN 786. Special MSChE Project **Credits 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 CHEN 796.

CHEN 789. Special Topics **Credits 3 (3-0)**

A course design to allow the introduction of potential new courses on a trial basis or 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.

CHEN 792. Masters Seminar **Credits 1 (1-0)**
This course provides a forum for the presentation and discussion of selected topics of interest to chemical engineering graduate students such as faculty research interests, communication, safety, job prospects and research results. Seminar credits do not apply to degree requirements.

CHEN 793. Masters Supervised Teaching **Credits 3 (3-0)**
This course is designed to provide the Masters student with an introduction to classroom teaching under the supervision of a faculty mentor. The student will observe and participate in classroom teaching, lecture preparation, student evaluation, and grading. Masters students may take this course only during a semester that they serve as a teaching assistant. The course supervisor(s) will observe and provide feedback to the student during the assignment and evaluate the students performance. Credits for this course do not apply toward degree requirements.

CHEN 794. Master's Supervised Research **Credits 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 masters student.

CHEN 796. Master's Project **Credits 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 and an oral defense are required.

CHEN 797. Master's Thesis **Credits 3 (3-0)**
The student will select, complete, present and defend a thesis topic under the direction of his/her graduate advisor.

CHEN 799. Continuation of Master's Thesis **Credits 1(1-0)**
Continuation of Master's thesis under the direction of his/her graduate advisor.

Master of Science in Bioengineering

Description of the Program

The Master of Science in Bioengineering program is a two-year engineering program and will be open to students who have completed their BS degree in science or engineering. The Master of Science in Bioengineering (MS BMEN) emphasizes advanced study in two specialization areas: (i) biomaterials and biomechanics, and (ii) bioimaging, biosignals and biosensors. The program provides graduate level education designed to prepare the graduate for Ph.D. level studies or for advanced bioengineering practice in industry, consulting, or government service.

North Carolina A&T State University (NCAT), in partnership with University of Pittsburgh and University of Cincinnati, currently has been awarded an NSF Engineering Research Center (ERC) on metallic biomaterials. The ERC will be instrumental in providing the bioengineering program with intramural internships involving the research efforts related to the ERC, in particular in the three Engineered Systems (ESs), namely Craniofacial and Orthopedic Applications; Cardiovascular Devices; and Responsive Biosensors for Implants. Bioengineering students will have the opportunity to work in the laboratories of the faculty members associated with the ERC at the three lead academic institutions. Additionally, the electives in bioengineering will be developed based on the knowledge base required to perform state-of-the art R&D related to the ESs; for example, Biomaterials and Biocompatibility; Tissue Engineering & Regenerative Medicine; and Nanoscience and Nanofabrication. Courses will be developed by the participating ERC faculty and taught either on the NCAT campus or online using internet technology and originating from Pitt and UC.

The program offers exciting industrial internships and co-operative programs in collaboration with the ERC industrial partners. Additionally, students who choose to practice biomedical engineering at the interface between bioengineered technologies and patients and their care givers would be invited to perform a "clinical rotation" at the Pitt Clinical Artificial Heart Program, where ventricular assist devices are used to support both adult and pediatric patients in refractory heart failure. Thus, we envision a very innovative and unique program that capitalizes on the faculty expertise at NCAT, Pitt and UC; provides both breadth and in-depth coursework that will allow our students to develop the underlying skills required to participate in the type of R&D proposed in the ERC; and, exposes the students to the translational aspects of bioengineered technologies - from bench-to-bedside. Furthermore, this program will provide study abroad opportunities at Hannover Medical School and at the Indian Institute of Technology Madras. We envision that this new program of study will be received very favorably by NCAT students, and be very well subscribed from the beginning.

The educational objectives of the program.

The educational objectives of the M.S. in Bioengineering program are to produce M.S. graduates in bioengineering who will:

- be prepared to work in teams to solve engineering problems
- demonstrate a sound knowledge of bioengineering topics,
- perform research in an area of bioengineering
- be competent in contemporary issues and be able to conduct interdisciplinary projects in bioengineering,
- be prepared to join the workforce and contribute to economic development

Applicants may be admitted to the MS BMEN Program under Unconditional or Provisional Admission:

Unconditional Admission

An applicant may be given unconditional admission to the MS BMEN Program if he/she possesses a BS degree in biomedical engineering or a related engineering specialty with an overall grade point average (GPA) of 3.0 or better.

Provisional Admission

Applicants may be granted provisional admission if they do not qualify for unconditional admission.
In particular, students entering from disciplines other than engineering may find it necessary to take preparatory undergraduate and/or graduate level courses that serve as prerequisites. Students admitted to the MS BMEN program are expected to have undergraduate preparation in

- calculus through differential equations,
- physics,
- chemistry,
- biology and physiology,
- selected engineering topics.

In addition, based on the specific research area, students may be asked to take additional courses in organic chemistry,

- genetics,
- biochemistry,
- linear systems,
- computer programming,
- analog and digital electronics,
- solid mechanics
- fluid mechanics,
- thermodynamics.

It should be noted that preparatory courses that are for undergraduate credit only may not be applied toward credit hours required for a graduate degree.

Documents to be submitted for admission (listing or sample).

Application forms must be submitted to the School of Graduate Studies with an official transcript of all previous undergraduate and graduate studies, and three letters of recommendation

- Application for graduate study
- BS transcripts
- Letters of recommendation
- TOEFL scores for international applicants.

Degree requirements.

Total hours required 30 credit hours including six (6) hours for a thesis. At least fifty (50) percent of the required credits must be through courses that are open only to graduate students.

Up to six (6) credit hours of graduate course work with a grade of "B" or better may be transferred from another graduate program at North Carolina A&T State University or from another university providing these courses, in the opinion of the advisor, can be part of a reasonable and cohesive graduate program. Up to six (6) credit hours of graduate course work with a grade of "B" or better taken at North Carolina A&T State University as a undergraduate student may be transferred to the MS BMEN program provided it was not counted to fulfill undergraduate requirements, and these courses, in the opinion of the advisor, can be part of a reasonable and cohesive graduate program. No graduate credit will be allowed for excess credits completed in an undergraduate classification at another institution.

Thesis

The MS BMEN degree requires all students to complete a thesis as part of the degree requirements. The thesis involves six (6) credit hours of masters thesis (BMEN 797) in addition to course work. An original research topic must be chosen in conjunction with the student's advisor culminating in the preparation of a scholarly thesis. The student must pass an oral examination which is scheduled by the advisor. The oral exam on the thesis is scheduled after the thesis has been reviewed by each member of the committee and approved with recommended changes. The exam is a public meeting; the committee deliberation following the meeting is open only to committee members. At the deliberation the committee will decide to pass or fail the student, or to continue the oral defense at another date. Three copies of the MS thesis must be submitted following the format specified by the School of Graduate Studies. Students will need to consult the calendar of the School of Graduate Studies for submission deadlines.

Advisory Committee

All graduate students must select an Academic Advisor during their first semester. The Advisory Committee consists of at least three members, with the Academic Advisor serving as the chair. The Academic Advisor and the majority of the Committee members must be MEEN graduate faculty members. The Committee assists the student to define the thesis or project topic area and reviews the quality of the student's work. The Committee also conducts the student's oral defense of the student's project or thesis work.

Plan of Graduate Study

All graduate students must prepare a Plan of Graduate Study during their first semester for approval by the Department and the Graduate School. The plan of course work must be unified, and all constituent parts must contribute to an organized program of study and research. The plan outlines courses, the program option, and the anticipated graduation date, among others. These plans should be updated every semester. 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 the 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 candidate resumes graduate work no later than one year following release from military service.

Courses:

The curriculum requirements will be structured to be consistent with the prominent national M.S. Bioengineering programs, and with other M.S. engineering programs at NCAT. The M.S. program will require 24 course credits and 6 credits of thesis. Course requirements will have nine (9) credit hours of common core courses, nine (9) credit hours of engineering electives, and six (6) credit hours of life sciences electives in consultation with the advisor.

Core (9 credit hours)

BMEN 711 (PITT/BIOE 2810) Biomaterials and Biocompatibility Credit 3 (3-0)

This course serves as an introduction to biomaterials and biocompatibility and assumes some background in organic chemistry and biology. The first half of the course connects material chemical properties to performance issues relevant to biomaterial applications. The second part of the course introduces biocompatibility issues as they follow from protein adsorption. Thrombosis, inflammation, and infection are of primary interest. Throughout the course ties are made between the topic of study and clinically relevant material and device performance.

BMEN 712. Research Methods and Design of Experiments Credit 3 (3-0)

This course addresses research methods and protocols and introduces experimental designs and data analysis for research projects. Specific topics covered include Latin Squares, complete and incomplete block designs, one, two, and three variable factorials, fractional factorials, nested designs, and 2k designs will be covered. Prerequisite: Graduate Standing.

BMEN 714 Fundamentals of Cell Biology for Engineers Credit 3(3-0)

This course examines the molecular events in cell function using molecular genetics, cell biology, and fundamental biochemistry; using both prokaryotic and eukaryotic systems

BMEN 735 Corrosion and Medical Mircro-devices Credit 3(3-0)

This course studies new technologies in biodegradable metallic implant science. This course will cover the following topics corrosion science, corrosion sensing devices and measurement systems, microfabrication of silicon, glass, polymer devices, microfluidics and electrokinetics, biosensors, actuators and drug delivery, Lab-on-a-chip and micro total analysis systems (µ-TAS), and genomics and proteomics related chip-based assays.

BMEN 792 Seminar: Credit 0 (1-0)

This course will introduce students to current government regulations, industry practices, global issues, project management approaches and current issues in bioengineering. Lectures will also include biotechnology ethics. External speakers will be invited. Prerequisite: Graduate Standing

Engineering electives (9 credit hours)

BMEN-685. Selected Topics in Bioengineering Variable 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.

BMEN 732 (PITT/BIOE 2064) Biomechanics of Organs, Tissues, and Cells Credit 3 (3-0)

Modern biomechanics is an increasingly diverse field that encompasses the mechanics of the whole human body and all the way to the cellular and molecular levels. This comprehensive course covers the application of solid mechanics to describe the mechanical behavior of organs, soft biological tissues, and cells. The course will include a review of fundamental concepts and techniques of mechanics (e.g. stress, strain, constitutive relations), and of the structure and composition of tissues and cells. The course will then focus on the mechanical properties of specific tissues, (e.g. tendon, muscle, heart, vascular) and cells (e.g. blood cells, valvular interstitial cells). Prerequisites: MEEN 702 or PITT/ME 2003 or equivalent.

BMEN 733 (PITT/BIOE 2067) Musculoskeletal Biomechanics Credit 3 (3-0)

This course will provide students with a detailed understanding of the structure and function of the tissues in the musculoskeletal system. Specific topics will include the kinematics, muscle forces and joint loads during human movement and the mechanics of the musculoskeletal connective tissues such as ligament, tendon, bone, cartilage and muscle. Special emphasis will be placed on the relationship between function and material properties of these tissues as revealed in the current scientific and engineering literature will be highlighted. A research paper that includes a computational analysis will be required as a term project.

BMEN 734 (PITT/BIOE 2072) Functional Tissue Engineering Credit 3 (3-0)

The design of engineered tissues involves both engineering and biological approaches. The focus of this course will be to introduce the student to the design of tissues from a Bioengineering perspective, with an emphasis on matching biomechanical behavior. For example, a mismatch in biomechanical properties between the cell/scaffold construct and the surrounding tissue can lead to catastrophic failure of an implant. Topics include review of extra-cellular matrix protein composition and structure, quantitative methods of tissue structural analysis, methods of biomechanical strength determination and basic modeling, scaffold composition, structure, and mechanical behavior, and utilization of in-vitro culture systems to obtain the desired structural and mechanical characteristics for long-term in vivo function.

BMEN 737 (PITT/ BIOE 2620) Introduction to Tissue Engineering Credit 3 (3-0)

This course is designed to introduce students to an understanding of tissue engineering (TE), and the biomaterials, cells and growth factors used in TE. Specific applications include skin, nerve, bone, and soft tissue regeneration. Throughout the course ties are made between the topic of study and clinically relevant situations.

BMEN 835 (PITT/ BIOE 2515) Cardiovascular System Dynamics and Modeling Credit 3 (3-0)

The mechanical behavior of the cardiovascular system will be explored in a quantitative manner. The goal is to understand the behavior of each component in isolation and the interactions among various components. Mathematical modeling will be used with an emphasis on model development, validation, and application. The function of the intact organ will be correlated with underlying structural and cellular processes, both for normal and pathological states. Student projects will use (and contribute to) the existing library of cardiovascular models. Permission by instructor.

BMEN 736 (PITT/BIOE 2075) Advanced Biomaterials Credit 3 (3-0)
This course is designed to introduce students to a more advanced understanding of biomaterials used for reconstructive surgery. This includes skin, nerve, bone, and soft tissue regeneration. Biomaterials available for burn patients, cancer patients, and trauma patients are the central theme of this course. Throughout the course ties are made between the topic of study and clinically relevant biomaterial performance. Prerequisites: BMEN 711 or PITT/BIOE 2810 or equivalent.

BMEN-885. Advanced Special Topics in Bioengineering Credit 3 (3-0)
The course will address a current body of knowledge in Bioengineering with a research orientation. Term papers and projects will be required. Prerequisites: Graduate Standing and Consent of Instructor.

CHEN-605 Biochemical Engineering Credits 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.

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.

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.

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-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.

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-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-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-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.

Bioimaging, Biosignals and Biosensors
BMEN-685. Selected Topics in Bioengineering Variable 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.

BMEN 741 (PITT/BIOE 2380) - Medical Imaging Systems I Credit 3 (3-0)
A systems perspective introduction to the fundamentals of medical imaging techniques used to generate cross-sectional images of patients. Emphasis on use of multi-dimensional Fourier transforms to develop the generalized central-section theorem used in tomography at the imaging equation used in MRI. The critical concepts of image SNR and image quality will also be introduced. MRI and x-ray CT are used as two sample modalities to explore these basic concepts.

BMEN 842 (PITT/BIOE 2382) - Medical Imaging Systems II Credit 3 (3-0)
Intended for students with a background in linear systems and transforms (especially Fourier analysis), this course delves into the unique physical mechanisms of major medical imaging modalities: X-ray, MRI, Ultrasound, and Nuclear Medicine. Propagation of the underlying physics through the imaging process will be used to examine current research issues of selected modalities. Prerequisites: BIOE/EE 1380 (Medical Imaging Systems I) or equivalent, an introductory course in statistics and/or probability theory.

BMEN 843 (PITT/BIOE 2630) - Methods in Image Analysis Credit 3 (3-0)
The fundamentals of computational medical image analysis will be explored, leading to current research in applying geometry and statistics to segmentation, registration, visualization, and image understanding. Student will develop practical experience through projects using the National Library of Medicine Insight Toolkit (ITK), a new software library developed by a consortium of institutions including the University of Pittsburgh. In addition to image analysis, the course will describe the major medical imaging modalities and include interaction with practicing radiologists at UPMC.

BMEN 844 (PITT/BIOE 2600) – Neuroimaging Credit 3 (3-0)
This course consists of six state-of-the-art imaging techniques (i.e., MRI, MRS, fMRI, PET, MEG/EEG and Optical). Each part of the module will present indepth analysis of the each technique and its application in neuroscience research. Apart from in-depth presentation of the each technique, students will also get acquainted with the operation of the respective instruments. Tour to that respective facility will be guided by the concerned faculty and scientific staff member in that respective facility will assist for demonstration.

BMEN-885. Advanced Special Topics in Bioengineering Credit 3 (3-0)
The course will address a current body of knowledge in Bioengineering with a research orientation. Term papers and projects will be required. Prerequisites: Graduate Standing and 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-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. Prerequisites: ELEN--400 or consent of instructor.

ELEN-657 Digital 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-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. Prerequisites: ELEN-449 or consent of instructor.

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-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-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. Prerequisites: ELEN-668 or equivalent.

Life sciences electives (6 credit hours)
Take six (6) credit hours from these elective courses:

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-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-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-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.

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-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.

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.

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-674. Computational Methods in Protein Modeling and Drug Design Credit 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.

CHEM-756. Selected Topics in Biochemistry Credit 3 (3-0)
A lecture course on advanced topics in Biochemistry.

MCEN 610 Biological Applications of Engineering Credits 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: Senior or graduate standing in engineering or permission of instructor.

Special Courses

BMEN-685. Selected Topics in Bioengineering Variable Credit 3(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.

BMEN 713. Biotechnology Entrepreneurship Credit 3 (2-2)
This course introduces students to innovation and entrepreneurial skills development oriented toward a biotechnology and bioengineering enterprise. Topics covered include intellectual property development, technology transfer, evaluation of market viability, financing, marketing and operations. The course will also cover government regulations. Prerequisite: Graduate Standing.

BMEN 741 (PITT/BIOE 2380) - Medical Imaging Systems I Credit 3 (3-0)
A systems perspective introduction to the fundamentals of medical imaging techniques used to generate cross-sectional images of patients. Emphasis on use of multi-dimensional Fourier transforms to develop the generalized central-section theorem used in tomography at the imaging equation used in MRI. The critical concepts of image SNR and image quality will also be introduced. MRI and x-ray CT are used as two sample modalities to explore these basic concepts.

BMEN-694. Special Projects Variable 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

BMEN 792 Seminar: Credit 1 (1-0)
This course will introduce students to current government regulations, industry practices, global issues, project management approaches and current issues in bioengineering. Lectures will also include biotechnology ethics. External speakers will be invited. Prerequisite: Graduate Standing

BMEN-797. Master's Thesis Variable Credit 1-6
This course provides the student an opportunity to complete a piece of original research, of their choice, in bioengineering, 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 BMEN

BMEN-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 BMEN

BMEN 835 (PITT/ BIOE 2515) Cardiovascular System Dynamics and Modeling Credit 3 (3-0)
The mechanical behavior of the cardiovascular system will be explored in a quantitative manner. The goal is to understand the behavior of each component in isolation and the interactions among various components. Mathematical modeling will be used with an emphasis on model development, validation, and application. The function of the intact

organ will be correlated with underlying structural and cellular processes, both for normal and pathological states. Student projects will use (and contribute to) the existing library of cardiovascular models. Permission by instructor.

BMEN 836 (PITT/BIOE 2075) Advanced Biomaterials Credit 3 (3-0)
This course is designed to introduce students to a more advanced understanding of biomaterials used for reconstructive surgery. This includes skin, nerve, bone, and soft tissue regeneration. Biomaterials available for burn patients, cancer patients, and trauma patients are the central theme of this course. Throughout the course ties are made between the topic of study and clinically relevant biomaterial performance. Prerequisites: BMEN 731 or PITT/BIOE 2810 or equivalent.

BMEN 842 (PITT/BIOE 2382) - Medical Imaging Systems II Credit 3 (3-0)
Intended for students with a background in linear systems and transforms (especially Fourier analysis), this course delves into the unique physical mechanisms of major medical imaging modalities: X-ray, MRI, Ultrasound, and Nuclear Medicine. Propagation of the underlying physics through the imaging process will be used to examine current research issues of selected modalities. Prerequisites: BIOE/EE 1380 (Medical Imaging Systems I) or equivalent, an introductory course in statistics and/or probability theory.

BMEN 843 (PITT/BIOE 2630) - Methods in Image Analysis Credit 3 (3-0)
The fundamentals of computational medical image analysis will be explored, leading to current research in applying geometry and statistics to segmentation, registration, visualization, and image understanding. Student will develop practical experience through projects using the National Library of Medicine Insight Toolkit (ITK), a new software library developed by a consortium of institutions including the University of Pittsburgh. In addition to image analysis, the course will describe the major medical imaging modalities and include interaction with practicing radiologists at UPMC.

BMEN 844 (PITT/BIOE 2600) – Neuroimaging Credit 3 (3-0)
This course consists of six state-of-the-art imaging techniques (i.e., MRI, MRS, fMRI, PET, MEG/EEG and Optical). Each part of the module will present indepth analysis of the each technique and its application in neuroscience research. Apart from in-depth presentation of the each technique, students will also get acquainted with the operation of the respective instruments. Tour to that respective facility will be guided by the concerned faculty and scientific staff member in that respective facility will assist for demonstration.

BMEN-885. Advanced Special Topics in Bioengineering Credit 3 (3-0)
The course will address a current body of knowledge in Bioengineering with a research orientation. Term papers and projects will be required. Prerequisites: Graduate Standing and Consent of Instructor.

Facilities and Equipment

The program is supported by existing facilities and equipment in the University's Interdisciplinary Institutes, Centers, and Programs. In addition, funds are available to establish new laboratories. The university is also committing space to house the department offices and instructional laboratories.

<u>Existing Laboratory Facilities</u>
High Performance Computing Systems
The following high performance and parallel computing resources along with their system, compiler and hardware resources are available. The computer hardware available are:

- 32 processor SGI 3900 systems with 32 GB memory and 1TB disk space (a shared memory architecture system) with system software and compilers.
- 18 node 36 process IBM Linux cluster (a distributed memory cluster)
- 8 processor SGI Altix

Scientific Visualization Laboratory
The scientific visualization laboratory has several end-user systems based on Windows, Linux and SGI Irix to meet the graphical visualization needs of the students. The laboratory houses a 6 projector stereo immersive visualization system. Additional equipment includes the color and black white printers. Several visualization software (AVS, Ensight, Paraview, VTK, etc) are also available to meet the diversified needs of both the applications and graphical developments.

Center for Advanced Materials and Smart Structures (CAMSS)

This center focuses on experimental, analytical and computational research in several aspects of material sciences and innovative material and sensor systems. The facilities include morphological facilities with high powered electron microscopes (Scanning Electron Microscope), Atomic Force Microscope (AFM), X-Ray Diffraction, etc., that complement the computational material science focused research. Doctoral students with research activities in the areas of computational material science and mechanics will have access to these facilities and faculty expertise available with the CAMSS center. The Center is headquartered at NCAT in the Fort Interdisciplinary Research Center (IRC). Materials laboratories occupy 10,000 sq. ft. of this building. The twelve current labs and facilities are interconnected and span 3 of the 5 floors of this building, providing a seamless state of-the-art materials research infrastructure valued at over $6 M (http://camss.ncat.edu). The IRC supports a highly advanced cyber-infrastructure, Materials Processing and Sample Preparation, Electron Microscopy, Bio-Polymeric Smart Materials, Surface Characterization and Microscopy, XRD, Physical Property Measurement, and Mechanical Testing Laboratories. The interconnectedness and the open-door state of-the-art research facility create a hub for interdisciplinary knowledge sharing that is critical for bioengineering discipline.

FACULTY DIRECTORY

Dr. Narayan Bhattarai PhD. Chonbuk National University, Jeonju South Korea	McNair 326	334-7562x107	nbhattar@ncat.edu
Dr. Matthew B. McCullough PhD. University of Iowa	McNair 327	334-7562x117	mattbn@ncat.edu
Dr. Leonard Uitenham PhD Case Western Reserve University	McNair 342	334-7620 x 310	u10ham@ncat.edu
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Dr. Devdas Pai PhD. Arizona State University	201 IRC	256-1151 x 2106	pai@ncat.edu
Dr. Jag Sankar PhD. Leigh University	242 IRC	256-1151x 2282	sankar@ncat.edu

Directory of Faculty

Yusuf G. Adewuyi, Professor, PhD, University of Iowa
Shamsuddin Ilias, Professor & Graduate Program Coordinator, PhD, Queen's University at Kingston
Vinayak N. Kabadi, Professor & CAS Associate Director, PhD, Pennsylvania State University
Franklin G. King, Professor, DSc, Stevens Institute of Technology
Jianzhong Lou, Professor, PhD, University of Utah
Kenneth L. Roberts, Associate Professor, PhD, University of South Carolina
Gary B. Tatterson, Professor, PhD, The Ohio State University.
Leonard C. Uitenham, Professor & Chairperson, PhD, Case Western Reserve University

Chemistry

Debasish Kuila, Chairperson
Room 348, Science Building
(336) 285-2240
dkuila@ncat.edu

OBJECTIVES

The objective of the Graduate program in Chemistry is to provide theoretical and experimental training for students pursuing M.S. in Chemistry, M.A. in Teaching Chemistry, interdisciplinary M.S. in computer science and engineering, and interdisciplinary Ph.D. in Energy and Environmental Systems. The Department also offers special courses that may be used for teacher renewal certificates.

DEGREES OFFERED

Master of Science- Chemistry
Master of Arts in Teaching - Chemistry

GENERAL REQUIREMENTS

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

1. Unconditional admission
2. Provisional admission

DEPARTMENTAL REQUIREMENTS

Admission to degree programs for the Master of Science in Chemistry and the Master of Arts in Teaching - Chemistry require a baccalaureate degree from an accredited undergraduate institution. Unconditional admission to the Master of Science in Chemistry requires an undergraduate degree in chemistry that includes one year of physical chemistry and one year of differential and integral calculus.

M.S. in Chemistry:- Thesis Option

1. **Required Core Courses**:	**Credit**
Chemistry 711 — Structural Inorganic Chemistry	3.0
Chemistry 722 — Advanced Organic Chemistry	3.0
Chemistry 743 — Chemical Thermodynamics	3.0
Chemistry 701 — Seminar	1.0
Chemistry 732 — Advanced Analytical Chemistry	3.0
Chemistry 799 — Thesis Research	3.0
Chemistry 702 — Chemical Research	3.0 -9.0
(A maximum of 9 hrs. may be earned in 702.)	

2. Other Requirements:

a. 2-9 semester hours in electives
b. Successful completion of 30 credit hours, at least 17 credit hours at 700 level
c. Satisfactory completion of an examination in foreign language or computer language
d. Pass comprehensive examinations
e. Satisfactory presentation and defense (open to public) of a thesis.
f. Thesis to be submitted to the School of Graduate Studies
g. One academic year of residence at A&T
h. Regular attendance of departmental seminars

M.S. in Chemistry –Project Option

This option requires 30 hours of course work and 3 credits of project research (CHEM703). Of the 33 credit hours of course work, at least 17 credits must be at the 700 level. The advisor and the student select a suitable project of mutual interest. 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 are required to defend their findings in a public seminar and submit a final report on their project.

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 credit hours from the Chemistry electives and the other 5 credit hours 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 College of Arts & Science, School of Agriculture and Environmental Sciences, or College of Engineering

3. Other Requirements:
a. Satisfactory completion of an examination in foreign language or computer language
b. Satisfactory presentation and defense of the project
c. One academic year of residence at A&T
d. Pass comprehensive examinations.

Master of Arts in Teaching – Chemistry

Entrance Requirements - Minimum 2.5 GPA

Prerequisites - 11 or more hours as needed
a. One year of physical chemistry
b. Organic Chemistry II
c. General Biochemistry
d. Qualitative and Quantitative Analysis

Phase I (Initial Licensure Coursework) 24 hours

Course	Title	Credit Hours
CHEM 611	Advanced Inorganic Chemistry	3.0
CHEM 621	Intermediate Organic Chemistry	3.0
CHEM 732	Environmental Chemistry	3.0
CHEM 643	Introduction to Quantum Mechanics	3.0
CHEM 651	Advanced Biochemistry	3.0
CHEM 703	Methods of Chemistry Instruction Internship I	3.0
CHEM 704	Methods of Chemistry Instruction Internship II	3.0
CUIN 624	Teaching Reading in the Secondary School	3.0

Benchmark - Minimum 3.0 GPA, Pass PRAXIS II, teach successfully for a minimum of one year or complete 12 semester hours of student teaching. Students must take the GRE to advance further.

Phase II (Advanced Studies Coursework) 15 hours

Course	Title	Credit Hours
CHEM 703	Master Project Research	3.0
CUIN 711	Research and Inquiry	3.0
CUIN 729	Diversity	3.0
CUIN 728	Technology	3.0
CUIN 721	Advanced Methods	3.0
CUIN 713	Learning Theories	3.0
CUIN 788	Comprehensive Exam	0.0

Exit Requirements -

Notes: **See Curriculum & Instruction section for detailed course descriptions.**

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	3
CHEM 674	Computational Methods in Protein Modeling and Drug Design	3

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

(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
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, chronopotentionmetry, potential sweep chronoampereometry 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 **Credit 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. Co-requisite: 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 **Credit 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. Awritten 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.

Directory of Faculty

William Adeniyi, B.A., Hampton University; M.S., Loyola University; Ph.D., Baylor University, Analytical Chemistry; Associate Professor
Zerihun Assefa, B. S., Addis Ababa University (Ethiopia); Ph.D., University of Maine, Inorganic Chemistry; Associate Professor
Mufeed Basti, B.S., Baath University (Homs, Syria); Ph.D., North Illinois University, Physical Chemistry; Associate Professor
Marion Franks, B.S., Clark-Atlanta University, Ph.D., Virginia Polytechnic Institute and State University. Organic Chemistry, Associate Professor
Etta Gravely, B.S., Howard University; M.S., North Carolina A&T State University; Ed.D., UNC-Greensboro; Associate Professor
Vallie Guthrie, B.S., North Carolina A&T State University; M.A., Fisk University; Ed.D., American University; Associate Professor
Julius Harp, B.S., York College (Jamaica, NY); Ph.D., Howard University, Organic Chemistry, Associate Professor
Margaret Kanipes, B.S., North Carolina A&T State University, Ph.D., Carnegie-Mellon University, Associate Professor
Debasish Kuila, B.Sc. (Hons.), Calcutta University, India; M.Sc., Indian Institute of Technology, Madras, Ph.D., The City University of New York; Professor
Jothi Kumar, B.Sc., Annamalai University, India; Ph.D., Kansas State University, Professor
Claude N. Lamb, B.S., Mount Union College; M.S., North Carolina Central University; Ph.D., Howard University; Organic Chemistry, Associate Professor
Divi Venkateswarlu, B.S., Sri Venkateswara University, M.S., Kakatiya University, M.Phil. University of Hyderabad, Ph.D., North Eastern Hill University, Associate Professor
Alex N. Williamson, B.S., Jackson State University; Ph.D., University of Illinois; Inorganic Chemistry, Associate Professor

Civil and Environmental Engineering

Sameer Hamoush., Chairperson
CAAE Engineering Department
448 McNair Hall
(336) 334-7575

The Master of Science program in Civil Engineering is administered by the Civil, Architectural and Environmental Engineering (CAAE) Department and is designed to accommodate graduates from Civil and Environmental Engineering, and Architectural 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, Construction Management, 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 Environmental 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 AT&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, 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 767	Value Analysis in the Design and Construction of Buildings	3 (3-0)
CIEN 768	Illuminating and Power Systems for Built Environments	3 (3-0)
CIEN 769	Advanced HVAC System Design and Analysis	3 (3-0)
CIEN 770	Energy Management Planning	3 (3-0)
CIEN 771	Energy Conservation Systems	3 (3-0)
CIEN 772	Measurement &Verification of Energy Use in Built Environment	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

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 pre stressed 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 non uniform 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.

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. Multi objective 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 poroelestic 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-767. Value Analysis in the Design and Construction of Buildings **Credit 3(3-0)**
The course covers the use of simulation and mathematical modeling as design analysis tools to minimize building life cycle costs. Structural systems, heating and air conditioning systems, lighting and power, plumbing and fire protection systems are included as part of the analysis. Value engineering principles are presented as they are applied to the design of buildings.

CIEN-768. Illuminating and Power Systems for Built Environments **Credit 3(3-0)**
The course develops numerical methods and methodology for solving special problems in electrical power distribution and lighting design. Topics include advanced numerical methods, and lighting and power system design for interior and exterior applications. The application and use of lighting, electrical and energy codes and standards are discussed.
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CIEN-769. Advanced HVAC System Design and Analysis **Credit 3(3-0)**
This course addresses the design, sizing, and selection methodology of all air, air-water and hydronic systems. The theory and application of pumps, fans, and heat-exchangers, air washers, cooling towers and terminal units, duct and pipe design methods are covered. Primary and secondary hydronic systems are covered including system air control techniques.

CIEN-770. 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.

CIEN-771. Energy Conservation Systems **Credit 3(3-0)**
The course presents the various utility rate structures, and energy auditing techniques. The energy reduction methods are discussed for lighting management, electrical power distribution and motors, steam production and distribution as well as HVAC systems. Various retrofit options and computerized Energy Management Systems (EMS) are investigated. The course also involves the study and application of renewable energy sources for buildings to achieve the goal of net zero energy (NZE) buildings.

CIEN-772. Measurement and Verification of Energy Use in Built Environment **Credit 3(3-0)**
The course deals with energy markets, international and national and regional regulatory structures, basic understanding of Measurement and Verification concepts, tools and protocols. The topics are covered with examples and case studies. Metering devices for various utilities like water, gas, electricity, steam, chilled and hot water are discussed. Remote sensing techniques are also covered. Modeling, data collection, storage and management are discussed.

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.

Directory of Faculty

Taher Abu-Lebdeh, **Assistant Professor**
B.S., M.S., Yarmouk University, Jordan; Ph.D., Louisiana State University; Professional Engineer
Ronnie S. Bailey, **Associate Professor**
B.A., Howard University; M.U.P., University of Wisconsin

Shoou-Yuh Chang, **Professor and DOE Samuel Massie Chair**
B.S., M.S., National Taiwan University; M.S., University of North Carolina at Chapel Hill; Ph.D., University of Illinois at Urbana-Champaign; Professional Engineer
Wonchang Choi, **Assistant Professor**
B.S., Kyung-hee University; B.S., M.S., Hong-ik university; Ph.D., North Carolina State University.
Peggy Fersner, **Adjunct Associate Professor and Coordinator, Geomatics**
B.S., Virginia Polytechnic Institute and State University; M.S., Clemson University; Professional Engineer
Ellie Fini, **Assistant Professor**
B.S., Isfahan University of Technology; B.S., M.S., Sharif University of Technology ; Ph.D., University of Illinois Urbana Champaign.
Sameer A. Hamoush, **Professor**
B.S., University of Damascus; M.S., University of Nebraska; Ph.D., North Carolina State University; Professional Engineer
Manoj K. Jha, **Assistant Professor**
B.E., Tribhuva University; M.E. Asian Insitute of Technology; M.S., Ph.D., Iowa State University
Stephanie Luster-Teasley, **Assistant Professor of Civil and Chemical Engineering**
B.S., North Carolina A&T State University; Ph.D., Michigan State University
Nabil Nassif, **Assistant Professor**
B.S., University of Damascus; B.S., M.S., University of Damascus; Ph.D., Quebec University, Canada
Jerry Nave, **Assistant Professor**
B.S., Virginia Polytechnic Institute and State University; M.S., Clemson University; Professional Engineer
Miguel Picornell, **Professor and Coordinator, Civil Engineering Program**
B.S., Madrid Polytechnic University; M.S., Ph.D., Texas A&M University; Professional Engineer
Robert Powell, **Assistant Professor**
B.S., Stanford University; M.Arch., M.I.T.
Peter Rojeski, Jr., **Professor and Coordinator Architecttural Engineering**
B.S., Clarkson College of Technology; M.S., Ph.D., Cornell University; Professional Engineer
M. Reza Salami, **Professor**
B.S., M.E., Virginia Polytechnic Institute and State University; Ph.D., University of Arizona; Professional Engineer
Harmohindar Singh, **Professor of Architectural and Mechanical Engineering and Director, Center for Energy Research and Training**
B.Sc., M.Sc., Punjab University; M.S., Ph.D., Wayne State University; Professional Engineer

Computational Science and Engineering Program

Sanjiv Sarin, Associate Dean (sarin@ncat.edu)
College of Engineering
Chairperson, Computational Science and Engineering
301 Fort IRC Building, (336) 334-7437
Graduate Program Coordinator: Ram Mohan (rvmohan@ncat.edu)
www.eng.ncat.edu
www.ncat.edu

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 that are required for computational modeling and analysis.
2. To educate and train students in computational modeling, simulation and visualization.
3. To assist students to relate and engage the acquired computational science and engineering knowledge and skills to specific application fields of engineering, science, technology and business with expertise in the associated domain fields and their computational aspects.
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.

DEGREES OFFERED

Master of Science (M.S.) in Computational Science and Engineering
Doctor of Philosophy (Ph.D.) in Computational Science and Engineering

GENERAL PROGRAM ADMISSION REQUIREMENTS
(MASTER OF SCIENCE)

Candidates seeking admission to the Computational Science and Engineering (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.
2. Computational Science track: Bachelor's degree in Chemistry, Biology, Business and Agricultural Sciences.
3. Computational Technology track: Bachelor's degree in Technology or related field.
4. Official TOEFL scores of at least 550 or better (213 computer-based score) for students whose native language is other than English. In addition all international students are required to submit official GRE scores. Scores should be submitted directly to the School of Graduate Studies.
5. General prerequisites: (1) Calculus through differential equations for the computational science and engineering track, (2) college chemistry and physics, (3) college math (4) elementary numerical analysis or one semester of linear algebra for the computational science and engineering track. These are in addition to the courses in the student's principal undergraduate 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 TOEFL score, if applicable, mailed directly to the University from the testing agency.
4. The completed application form and application fee stipulated by the School of Graduate Studies at NC A&T State University.
5. A "Statement of Purpose" in the context of pursuing the M.S. degree in Computational Science and Engineering.

Computational Science and Engineering Tracks

All students in the M.S. program will complete a set of four core courses. In addition, based on their domain background and undergraduate discipline, the following tracks are identified to assist with their domain course selection, guidance, and advice.

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

Master of Science

The M.S. program in computational science and engineering 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 successfully 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 partial 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 Engineering: MEEN 655, MEEN 716, MEEN 719, MEEN 822, MEEN 846, MEEN 847, MEEN 849
Civil Engineering: CIEN 600, CIEN 614, CIEN 668, CIEN 644, CIEN 660, CIEN 662, CIEN 664, CIEN 700, CIEN 702, CIEN 736, CIEN 737, CIEN 754
Industrial Engineering: INEN 615, INEN 624, INEN 665, INEN 721, INEN 742, INEN 745, INEN 813, INEN 814, INEN 822, INEN 841, INEN 843, INEN 844, INEN 853
Computer Science: COMP 653, COMP 662, COMP 670, COMP 732, COMP 733, COMP 747, COMP 753, COMP 755, COMP 770, COMP 785
Electrical Engineering: ELEN 656, 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 Engineering: CHEN 630, CHEN 620, CHEN 640, CHEN 710, CHEN 720, CHEN 730, CHEN 740, CHEN 760
Physics: PHYS 605, PHYS 630, PHYS 744, PHYS 745
Mathematics: MATH 608, MATH 624, MATH 631, MATH 652, MATH 706, MATH 708, MATH 712, MATH 721, MATH 723, MATH 731, MATH 781, MATH 782

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 674, CHEM 731, CHEM 732, CHEM 741, CHEM 742, CHEM 743, CHEM 749, CHEM 735, CHEM 755
Agribusiness and Science: AGEC 638, AGEC 675, AGEC 705, AGEC 708, AGEC 710, AGEC 720, AGEC 740, AGEC 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 630, BIOL 640, BIOL 642, BIOL 665, BIOL 700, BIOL 703, BIOL 704
Business and Economics : BUAD 715, BUAD 713, 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:
Construction Management and Occupational Safety and Health: MSIT 610, MSIT 779,
Electronics and Computer Technology and Manufacturing Systems: ECT 600, ITT 634, ECT 635, ITT 650, ITT 629, ITT 630, ITT 665, ITT 670, ITT 680, CUIN 760, CUIN 761,
Graphics Communication Systems: GCS 631, GCS 632,
Manufacturing Systems: MFG 651, MFG 674, MFG 696, MFG 760

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 Chair Person/Graduate Program Coordinator 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 Chairperson. 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 chairperson 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 700 Introduction to Computational Science and Engineer	3
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 Computational Techniques & Modeling for Nanoscience and Nanoengineering	3
CSE 712 Nano-Scale Technology	3
CSE 713 Multi-Scale and Multi-Physics Modeling	3
CSE 750 Topics in Computational Science	3
CSE 785 Special Topics	3

M.S. Level Pass/Fail Courses

CSE 792 Graduate Seminar	1
CSE 793 Master's Supervised Teaching	3
CSE 794 Master's Supervised Research	3
CSE 796 Masters Project	3
CSE 797 Masters Thesis	3
CSE 799 Continuation of Masters Thesis	1

COURSE DESCRIPTIONS

CSE 700. Introduction to Computational Science **Credit 3(3-0)**
This course covers the introduction and application of commonly used computational tools including computer algebra systems, interpreted languages used as scripting languages, and programming. This course also covers the basics of computational science including finite precision arithmetic, logic, and algorithmic design.

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. Computational Techniques and Modeling for Nanoscience and NanoengineeringCredit 3(3-0)
This graduate level course covers computational methods and techniques that are relevant to nano science and nano engineering. Computational techniques, modeling approaches relevant to nano length and time scales will be discussed in the context of computational nano mechanics and materials. Discussions will also include relevant multi-scale methods on the current techniques for bridging across length scales.

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 750. Topics in Computational Science **Credit 3(3-0)**
This course will focus on computational thinking. The student will learn how to express scientific concepts as a problem for a computer to help solve. The course covers the transformation from infinite precision mathematics to a discrete approximation which is implemented in a code or other appropriate tool for the computer.

CSE 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.

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 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 assignment. Prerequisite: Master's level standing.

CSE 794. Master's Supervised Research **Credits 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.

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.

DOCTOR OF PHILOSOPHY (Ph.D.)

The mission of the Computational Science and Engineering Ph.D. program is to create the next generation of qualified doctoral trained practitioners in the engineering disciplines, physical and biological sciences, computational science and engineering, energy and environment, technology and business and economic modeling. This interdisciplinary program has been designed for persons who desire to be proficient in computational methods and modeling analysis in the domain disciplines of engineering and sciences, and the associated practical use of advance and high-end computing architectures. The graduates of the program will have the knowledge and expertise of their domain disciplines and the associated computational modeling developments and applications in these domain disciplines. The Computational Science and Engineering PhD draw expertise and resources from among all fields of engineering, sciences, technology and business to prepare students to work effectively in today's environments.

GENERAL PROGRAM ADMISSION REQUIREMENTS
DOCTOR OF PHILOSOPHY (Ph.D.)

Admissions Requirement for Ph.D. in Computational Science and Engineering

(1) Admissions requirements for proposed program (indicate minimum requirements and general requirements

There are specific procedures in evaluating an applicant's potential for success in the Ph.D. program. Admissions decisions reflect an evaluation of the applicant's potential to engage in graduate coursework and independent and original investigations. Generally, requests for admission are considered by the program chair person through the graduate school standard admission procedure. Once an application is reviewed, an admission recommendation is forwarded to the Dean of the School of Graduate Studies. 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 School of Graduate Studies.

To be considered for admission to the Ph.D. in Computational Science and Engineering an applicant must satisfy the following requirements:

1. Master's degree in Computational Science and Engineering (CSE) or in science, engineering, business, economics, technology or in a closely related to computational science or computational engineering field with a minimum GPA of 3.25/4.0
2. GRE score of at least 1000
3. International Students: An official score report for the Test of English as a Foreign Language (TOEFL) with the score of at least 550 (written test) or 213 (computer-based test). This requirement maybe waived if the candidate has completed a bachelors or masters degree on a full-time basis at a university in the United States.

(2) Documents to be submitted for admission

The following documents are required by the School of Graduate Studies:

1. Completed application form and application fee stipulated by School of Graduate Studies at NC A&T State University.
2. Three letters of recommendation from former college professors or supervisors. *Two of the three recommendation letters **must be** from a university professor.*
3. Statement of Purpose in the context of pursuing the Ph.D. degree in Computational Science and Engineering.
4. A resume is necessary if you are interested in receiving financial support via University fellowships and assistantships, departmental assistantships, fellowships and other awards sponsored through federal, state, and private grants and contracts.
5. Official transcripts of all college-level academic work.
6. Official copy of GRE score mailed directly to the university.
7. Official copy of TOEFL score mailed directly to the university (international students only).
8. A **course-by-course** transcript evaluation (international students only).

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

Degree Requirements

The credit hours required for the program is 50 credit hours of core and domain courses beyond the M.S. degree. Of these 50 credit hours, 24 credit hours are for course work, 2 credit hours are for seminars, 6 credit hours are for professional practice/development, 3 credit hours for qualifying exam, 3 credit hours for PhD proposal defense, and a minimum of 12 credit hours are for dissertation research.

Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, "second major," etc.)

The requirement consists of the following elements:

1. General Core: 12 credit hours (required courses for all students in the program)
2. Doctoral Seminar: 2 credit hours (2 semesters of graded seminar required for all students in the program. Each seminar is for 1 credit hour and will be taken twice during the doctoral course of study);
3. Domain Courses: 12 credit hours; 6 credit hours from the fields of Computational Physics, Computational Chemistry, Computational Biology, Computational Mathematics, Computational Business/Finance, Computational Technology, Engineering (as long as courses involves computational or computer science aspects) according ot the major and research emphasis of the student, and 6 credit hours from the fields listed above including Energy and Environment studies and Engineering/Computer Science.
4. Professional development/practice requirement: 6 credit hours (required for all students in the program this includes 3 credit hours of Doctoral Supervised Research and 3 credit hours of Doctoral Supervised Teaching);
5. Dissertation Research: 12 credit hours (required for all students in the program.
6. Major Advisor: Initially the Chairperson of the Ph.D. program will serve as an 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 Chairperson. The major advisor must hold a tenure or tenure-track full-time faculty position at the university.
7. Composition of Ph.D. Committee: A Ph.D. Advisory Committee will consist of a minimum of five (5) graduate faculties with the major advisor as its chairperson. The Ph.D. Advisory Committee will be recommended by the major advisor, with input from the student, to the chairperson of the computational science and engineering Ph.D. program, for approval by the Dean of Graduate Studies. Upon the student's selection of a research area, the Ph.D. Advisory Committee will review the student's prior transcripts, evaluate and recommend any transfer credits, and prepare a program of study for approval by the chairperson of the Ph.D. program before submission to the Dean of Graduate Studies. The Committee will supervise the

student's program, administer dissertation review and approval, and finally recommend the awarding of the degree.

8. Qualifying Written Examination: 3 credit hours. A comprehensive written examination is proposed for all accepted Ph.D. students to ensure minimum competencies and to assist the students' committee in its coursework development program. All students admitted into the Ph.D. program are subject to a Qualifying Written examination after the completion of FIRST YEAR of Ph.D. coursework on an unconditional basis.
9. Oral Defense of Dissertation Proposal (Preliminary Examination): 3 credit hours (required for all students in the program). The dissertation proposal is submitted to the student's major advisor and the Ph.D. Advisory Committee for review. The committee will make recommendations as needed. 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 approval of the dissertation proposal, the student will register for the Computational Science and Engineering Ph.D. Dissertation course.
10. Admission to Candidacy for Ph.D. Degree in Computational Science and Engineering: Admission to candidacy for Ph.D. degree in Computational Science and Engineering: Admission to candidacy for Ph.D. degree in Computational Science and Engineering will require compliance with all existing Graduate School policies.
11. 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 all required course work has been completed or is currently in progress.
12. 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.
13. Degree Requirements: The student must successfully complete the approved program of study with a minimum cumulative GPA of 3.0 or better
14. Residency Requirements: For the Doctor of Philosophy degree, the student is expected to be registered for graduate work for at least four semesters beyond the master's degree. At least two residence credits, as defined below, must be secured in continuous residence (registration in consecutive semesters) as a graduate student at the university.

Current List of Courses	**Credits**
CSE 801 Advanced Statistics and Experimental Design	3
CSE 802 Advanced Numerical Analysis	3
CSE 803 Advanced High Performance and Scalable Computing	3
CSE 804 Advanced Scientific Visualization	3
CSE 805 Visual Analytics and Data Mining	3
CSE 885 Special Topics	3

Ph.D. Level Pass/Fail Courses

CSE 991 Doctoral Qualifying Exam	3
CSE 992 Graduate Seminar	1
CSE 993 Doctoral Supervised Teaching	3
CSE 994 Doctoral Supervised Research	3
CSE 995 Doctoral Preliminary Exam	3
CSE 997 Doctoral Dissertation	3
CSE 999 Continuation of Doctoral Thesis	1

CSE 801, CSE 802, CSE 803, and CSE 804 are required core courses for all the students of the CSE Ph.D. program.

COURSE DESCRIPTIONS

CSE 801. Advanced Statistics and Experimental Design **Credit 3(2-2)**

This course will cover advanced topics in the design and analysis of experimental and observational studies. An accompanying statistical software laboratory is a part of the course for learning to create, import and work with SAS data setup and using SAS procedures for statistical analysis and graphical displays.

CSE 802. Advanced Numerical Analysis **Credit 3(3-0)**
This course is an advanced level treatment of computational methods, algorithms, errors, stability and accuracy considerations, solution techniques for large scale computational systems that are applicable for the computational modeling in various branches of science and engineering.

CSE 803. Advanced High Performance and Scalable Computing **Credit 3(3-0)**
This course will focus on the very high end of parallel computing to include grid computing, cloud computing and remote storage that are key concepts for the next generation of computational approaches. New emerging concepts such as graphical processing unit (GPU) computing will be discussed.

CSE 804. Advanced Scientific Visualization **Credit 3(3-0)**
This course will extend the topics from CSE 704, including a survey of current available tools. This course covers the construction of visualization applications for specific analysis or display devices. The focus will be a project to write visualization codes using OpenGL or VTK specifically for 3D displays.

CSE 805. Visual Analytics and Data Mining **Credit 3(3-0)**
This course will focus on the use of visualization techniques to manage large data collections, and the use of visual tools to analyze data. This includes diverse areas of data acquisition such as web searching, bioinformatics and conformation analysis.

CSE 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 course as required at the doctoral level.

CSE 991. Doctoral Qualifying Exam **Credit 3(3-0)**
This supervised program is for students who are taking the CSE Ph.D. program qualifying examination to demonstrate the understanding of the core areas of CSE and their domain research area. It culminates in a scheduled written examination administered on a Pass/Fail basis and must be passed after the completion of the first year of Ph.D. coursework or an unconditional basis.

CSE 992. Doctoral Seminar **Credit 1(0-2)**
Seminars delivered by student researchers, faculty, and invited speakers. Participation in these seminars will count for 2 credit hours (1 credit hour for each academic year). The student receives a Pass/Fail and no letter grade is given upon completion.

CSE 993. Doctoral Supervised Teaching **Credit 3(0-6)**
This course introduces the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. The student receives a Pass/Fail and no letter grade is given upon completion.

CSE 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. The student receives a Pass/Fail and no letter grade is given upon completion.

CSE 995. Doctoral Preliminary Examination **Credit 3(3-0)**
This is required for students who have completed the CSE doctoral qualifying examination and who are taking the preliminary examination (oral preliminary defense). The student receives a Pass/Fail and no letter grade is given upon completion.

CSE 997. Doctoral Dissertation **Credit 3(3-0)**
This represents the supervised research leading to the dissertation for the doctoral student. The student receives a Pass/Fail grade only after the completion of the final Ph.D. oral defense.

CSE 999. Continuation of Dissertation **Credit 1(1-0)**
This course is for doctoral students who have completed all required credit hour requirements. This can be repeated by the students as required. The student receives a Pass/Fail and no letter grade given upon completion.

Computer Science

Gerry Dozier, 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++, or Java), 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, secure software engineering, artificial intelligence, computational science, distributed systems, multiagent systems, computer security, visualization and high performance computing.

Software Engineering:

The systematic approach to the development, operation, maintenance, and requirement 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.

Information Assurance:

With wide spread use of the Internet, Information Assurance has become a dominant issue in the Information Technology (IT) industry. Information Assurance has significantly influenced priorities for IT education, research, and development. To defend our homeland and stay at the forefront of scientific discovery, federal and local governments recognize the need for a well-trained workforce in emerging and advanced tools of information security. The rapid growth of Information Assurance in the job market created a need for well-trained workers at all levels, including the master's. Research topics include network security, Web security, wireless security, intrusion detection, information privacy and security, and software development security.

Secure Software Engineering:

Security vulnerabilities caused by software defects are costing business millions of dollars each year and threaten the security of individuals and the nation. To improve the current situation in industry and government, there is the pressing demand for well-trained software professionals who can develop quality and secure software. The program provides students with knowledge of requirements engineering for secure software, secure software architecture and design, secure coding and testing, and software security best practices, etc. Research topics include security requirements engineering, design for security, auditing software, implementation risks, application security, denial-of-service protection for concurrent software, and malicious code detection and analysis, etc.

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.

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.

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 visualization research group, as well as other research funded by agencies including the Naval Oceanographic Office.

LIST OF GRADUATE COURSES

COMP 611	System Testing and Evaluation
COMP 620	Information, Privacy, and Security %
COMP 621	Web 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 722	E-Commerce
COMP 723	Intrusion Detection
COMP 724	Security and Multiagent System
COMP 725	Software Security Testing $

COMP 726	Network Security
COMP 727	Secure Software Engineering $
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 768	Advanced Data Mining
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 793	Masters Supervised Teaching
COMP 796	Masters Project
COMP 797	Masters Thesis
COMP 799	Continuation Research

** = Core course, required of all students*
*** = Required for Artificial Intelligence specialization*
**** = Required for Software Engineering specialization*
%= Required for Information Assurance specialization
$= Required for Secure Software Engineering specialization
† = Required for Computational Science and Engineering specialization
 # = Required for General specialization

COURSES WITH DESCRIPTION IN COMPUTER SCIENCE

COMP-611. System Testing and Evaluation **Credit 3 (3-0)**
This course will focus on the methods, techniques, procedures for system testing and evaluation. The main topics include reliability measurement, testing small and large systems, black box software testing, white box software testing, testing of concurrent and real-time systems, client-server testing, test case design methods, and automated testing tools.

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-621. Web Security **Credit 3 (3-0)**
This course focuses on the technologies that provide security services for the World Wide Web. It introduces a set of procedures, practices, and technologies for protecting web servers, web users, and their surrounding organizations. We discuss, understand and use various security technologies for the World Wide Web (WWW). How to use these technologies to secure WWW applications will be addressed.

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.

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-722. E-Commerce **Credit 3 (3-0)**

This course covers the computer science and technology that enable e-commerce and the business concepts needed to understand e-commerce. Topics reviewed include HTML and CSS as well as client-side scripting. Topics introduced include e-commerce features, business models, and marketing concepts. Topics emphasized include the HTTP protocol, server-side scripting, the XML family of specifications, web services, the Semantic Web, and security in an e-commerce context.

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-724. Security and Multiagent Systems **Credit 3 (3-0)**

This course addresses agents that communicate and coordinate over the web. The focus is on DARPA Agent Markup Language (DAML) and similar contributions to the area known broadly as the Semantic Web. Necessary background in XML, RDF, and SOAP is covered. The course also considers specifications of security and trustworthiness properties for systems of such agents both using formal techniques (process algebras and modal logics) and considering social aspects of Web use (as in e-commerce).

COMP-725. Software Security Testing **Credit 3 (3-0)**

This course focuses on software security testing techniques and tools. It covers security testing techniques such as code reviews and static analysis, creating test plans based on risk analysis, black-box, white-box and gray-box security testing, fault injection etc. Security testing tools will be introduced.

COMP-726. Network Security **Credit 3 (3-0)**

The course covers various aspects of securing data during their transmission. It includes the following topics: vulnerabilities in software and hardware systems; cyber attack methods and their defense mechanisms; symmetric ciphers; public key ciphers; hash functions; message authentication and digital signature; public key infrastructure and web of trust; email security; web security; IPSec; firewall; intrusion detection system.

COMP-727. Secure Software Engineering **Credit 3 (3-0)**

This course discusses how to incorporate security throughout the software development lifecycle. The main topics include threats to the software, software vulnerabilities, risk management, security requirements, secure design principles and patterns, an overview of secure programming and security testing.

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-768. Advanced Data Mining **Credit 3 (3-0)**
This class focuses on the application of data mining theory. Data mining techniques and algorithms are brought to bear on real-world projects obtained from industry or other outside organizations. Students work in teams and are expected to write publication-quality articles.

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-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-799. Continuation of Research Credit 1 (1-0)
Continue incomplete thesis or project work.

Directory of Faculty

Sharon A. Brown, B.S., M.S., North Carolina A&T State University; M.S., University of Illinois; **Adjunct Associate Professor and Director of Undergraduate Studies**

Kelvin S. Bryant, B.S., North Carolina State University; M.S., North Carolina State University; Ph.D., North Carolina State University; **Adjunct Assistant Professor**

Gina Bullock, B.S Computer Science, Shaw University; M.S. Computer Science, North Carolina A&T State University, **Adjunct Assistant Professor**

Edward C. Carr, B.S., Wingate University; M.S., North Carolina A&T State University; M.S., Western Carolina University; **Adjunct Assistant Professor**

Gerry Dozier, B.S. Northeastern Illinois University; M.S. North Carolina State University; Ph.D., North Carolina State University; **Professor and Chairperson**

Edmundson Effort, B.S. NC A&T State University; M.S., NC A&T State University; Adjunct Assistant **Professor & System Administrator in College of Engineering**

Albert C. Esterline, B.A., Lawrence University; M.Litt., Ph.D, University of St. Andrews; M.S., Ph.D., University of Minnesota; **Associate Professor**

Jung Hee Kim, B.S., Korea University; M.S., Ph.D., Illinois Institute of Technology; **Associate Professor**

Kenneth A. Williams, B.S., M.S., Michigan Technological University; Ph.D., University of Minnesota; **Associate Professor**

Jinsheng Xu, B.S., Nanjing University; M.S., Beijing University; Ph.D., Michigan State University; **Associate Professor**

Xiaohong Yuan, B.S., Hua Zhong University of Science and Technology; Ph.D., Institute of Automation, Chinese Academy of Sciences; Ph.D., Florida Atlantic University; **Associate Professor**

Huiming (Anna) Yu, B.S., Xiamen University; M.S., Hefei Polytechnic University; Ph.D., Stevens Institute of Technology; **Professor and Director of Graduate Studies**

Construction Management and Occupational Safety & Health

http://www.ncat.edu/~cms/index.html

Robert B. Pyle, 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 encourage both theoretical and practical applications. Graduates receive, depending upon the degree option, instruction in: estimating, project management, planning and scheduling, 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 Technology Management
Occupational Safety and Health – Master of Science in Technology Management
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 Technology Management 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

Bachelor's degree in appropriate discipline and competitive undergraduate GPA are required for direct admission. The Master of Science in Technology Management within the School of Technology does not require the GRE General Test as part of the admission requirements. Please contact the Graduate School Office for more information.

DEPARTMENT REQUIREMENTS
MSTM in Technology Management/Construction Management

A total of 33 credit hours are required for Master of Science degree in Technology Management. The total consists of 12 semester hours of Technology Core Courses, 6 semester hours of Required Management Courses and 9 or 6 semester hours of Required Technical Electives for non-thesis or thesis, respectively

PROGRAM CURRICULA

CORE COURSES

MSIT 600	Graduate Seminar
MSIT 701	Leadership and Technological Innovation
MSIT 702	Enterprise Resource Planning Systems
MSIT 703	Industrial Statistics and Probability
MSIT 704	Research Methods for Technology

CM MANAGEMENT COURSES (REQUIRED)

CM 692	Project Management
CM 710	Advanced Construction Management and Organization

CM TECHNICAL COURSES REQUIRED
(6 credit hours [Thesis Option] 9 credit hours [Project Option])

CM 617	Independent Study I
CM 650	Construction Contracts and Law
CM 675	Advanced Construction Planning and Scheduling
CM 678	Real Estate and Land Development
CM 679	Environmental Issues in Construction Management
CM 690	Special Problems in Construction Management
CM 700	Ethics and Professional Issues in Construction Management
CM 704	Special Topics in Renewable Energy Technologies
CM 705	Human Resource Development in Construction Management
CM 708	Construction Cost Estimating & Project Controls
CM 715	Productivity & Methods Improvement in Construction
CM 720	Construction Contracts Administration
CM 780	Emerging Trends in Construction Management of International Projects
CM 781	Risk Management in Construction
CM 785	Construction Economics
CM 786	Construction Trends and Analysis

CM REQUIRED COURSES
(6 Credit Hours – Project Option)

CM 685	Graduate Internship I
CM 686	Graduate Internship II
CM 788	Master's Comprehensive Exam
CM 799	Continuation of Thesis
MSIT 750	Internship I

CM REQUIRED COURSES
(9 Credit Hours – Thesis Option)

MSIT 705	Statistics and Probability for Research or (CM 750 Research Methods in Construction)
MSIT 791	Research for Master's Thesis I
MSIT 792	Research for Master's Thesis II

CM MANAGEMENT COURSES (REQUIRED)
Concentration in Land Development

CM 678	Real Estate and Land Development
CM 710	Advanced Construction Management and Organization

LAND DEVELOPMENT TECHNICAL COURSES REQUIRED
(6 credit hours [Thesis Option] 9 credit hours [Project Option])

LAND 679	Regulatory Issues in Real Estate and Land Development
LAND 682	Sustainable Development & Construction
LAND 683	Planning and Development of Energy – Efficient Affordable Housing
LAND 700	Special Topics in Land Development
LAND 701	Directed Studies in Real Estate and Land Development
LAND 702	Special Problems in Economic and Community Development
LAND 703	Mixed-Use Development
LAND 705	Sustainable Planned Communities

CIEN 736 Facility Planning an Site Analysis
OSH 708Occupational Safety & Health Management I
CM 788 Master's Comprehensive Exam
CM 799 Continuation of Thesis

REQUIRED COURSES (6 Credit Hours – Project Option)

MSIT 750 Internship I
MSIT 789 Master's Project
MSIT 788 Master's Comprehensive Exam

REQUIRED COURSES (9 Credit Hours – Thesis Option)

MSIT 705 Statistics and Probability for Research or (CM 750 Research Methods in Construction)
MSIT 791 Research for Master's Thesis I
MSIT 792 Research for Master's Thesis II

DEPARTMENT REQUIREMENTS
MSTM /Occupational Safety and Health

A total of 33 hours is required for a Master of Science in Technology Management with concentrations in Occupational Safety & Health, Emergency and Disaster Management and Environmental and Occupational Safety & Health. The total consists of 12 semester hours of MSIT Core Courses, 6 semester hours of Management Courses and 6 credit hours (Thesis Option) and 9 credit hours (Project Option) of Technical Courses. The MSTMT Core Courses are the same courses as those listed for all MSTM concentrations.

MANAGEMENT ELECTIVES (6 Credit Hours)
Occupational Safety & Health

OSH 708 Occupational Safety & Health Management
OSH 709 Current Issues in Occupational Safety & Health

Emergency and Disaster Management and
Environmental and Occupational Safety & Health

OSH 678 Disaster & Emergency Management Policies
OSH 708 Occupational Safety & Health Management

TECHNICAL ELECTIVES – Occupational Safety & Health
6 Credit Hours (Thesis Option) 9 Credit Hours (Project Option)

OSH 600 Occupational Toxicology I
OSH 613 Industrial Hygiene Ventilations
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 Safety & Health
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

TECHNICAL ELECTIVES – Emergency and Disaster Management
6 Credit Hours (Thesis Option) 9 Credit Hours (Project Option)

OSH 655	The History of Emergency Management Organization and Theory
OSH 657	Disasters, Characteristics and Physical Impacts
OSH 659	Values and Ethics for Administrative Decision-Making or OSH 711
OSH 660	Risk Management and Boiler Safety
OSH 704	Occupational Epidemiology
OSH 708	Occupational Safety & Health Management
OSH 709	Current Issues in Occupational Health and Safety
OSH 710	Legal Issues in Occupational Health and Safety Practice
OSH 712	Education and Training Methods in Safety

TECHNICAL ELECTIVES – Environmental and Occupational Health & Safety
6 Credit Hours (Thesis Option) 9 Credit Hours (Project Option)

OSH 655	The History of Emergency Management Organization and Theory
OSH 656	Impact of Disaster on Cultures and Communities
OSH 659	Values and Ethics for Administrative Decision-Making or OSH 711
OSH 660	Risk Management and Boiler Safety
OSH 670	Research Methods in Occupational Safety & Health
OSH 709	Current Issues in Occupational Health and Safety

REQUIRED COURSES – Occupational Safety & Health, Emergency and Disaster Management and Environmental and Occupational Safety & Health
6 Credit Hours – Project Option

MSIT 750	Internship I
MSIT 789	Master's Project
MSIT 788	Master's Comprehensive Exam

REQUIRED COURSES – Occupational Safety & Health, Emergency and Disaster Management and Environmental and Occupational Safety & Health
9 Credit Hours – Thesis Option

MSIT 705	Statistics and Probability for Research or (OSH 670 Research Methods in OSH for EOSH only)
MSIT 791	Research for Master's Thesis I
MSIT 792	Research for Master's Thesis II

DEPARTMENT REQUIREMENTS
MSIT/Environmental and Occupational Safety and Health

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 (33 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 Remove 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, OSH and EOSH programs requires a minimum of 33 semester hours. All programs require a student to pass a written comprehensive examination or thesis. 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 is not required as of Fall 2007. 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)

<u>Construction Management</u>

CM 600. Senior Seminar **Credit 3(3-0)**
This seminar will address how to develop a comprehensive proposal for an actual construction project.

CM 601. Environmental Technology for Construction **Credit 3(3-0)**
A special project related to the construction industry is developed and implemented during the semester. Prerequisite: CM 600

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 rations, 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. Prerequisite CM 598.

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 and Graduate Standing.

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. Pre-Requisite: Graduate Standing.

CM 781. Risk Management in Construction **Credit 3(3-0)**

This course provides an indepth study of various risks associated with construction projects and how those risks impact the construction industry. Topics of discussion will include analytical and management techniques used to identify, analyse and respond to risks. Students will review actual legal case studies and develop written opinion papers.

CM 788. Master Comprehesive Exam **Credit 0(0-0)**

This course is the comprehensive exam for MSIT/CM students.

CM 999. Continuation of Thesis for Construction Management **Credit 1(0-1)**

This class is for graduate student who have completed all required course works and all thesis credits. The course allows students to maintain full-time enrollment following completion of the thesis.

LAND 679. Regulatory Issues in Real Estate and Land Development **Credit 3(3-0)**

This course deals with an indepth discussion of various regulatory issues affecting realestate and land development practices. Topics of discussion will include a review of real estate and land development laws, estates in land, permitting process, land use planning, and development controls.

LAND 682. Sustainable Development and Construction **Credit 3(3-0)**

This course deals with the principles and practices of sustainable development and construction. Historical development of sustainability and its application to building and construction practices will be studied. The role of Leadership in Energy and Environmental Design (LEED) organization and its Green Building Rating System will be thoroughly discussed as well.

LAND 683. Planning and Development of Energy-Efficient Affordable Housing **Credit 3(3-0)**

This course deals with the principles and practices of energy-efficient affordable housing development and construction. Students will review and analyse public policy and regulatory issues affecting affordable housing. Also, the role of public agencies in promoting affordable housing will be covered.

LAND 700. Special Topics in Land Development **Credit 3(3-0)**

This course deals with the study of special topics and emerging trends in land development. Individual students will select a specific topic from current literature and conduct an indepth study of the issues under the guidance of a graduate faculty.

LAND 701. Directed Studies in Real Estate and Land Development **Credit 3(3-0)**

Students will pursue an individual area of interest under the guidance of a graduate faculty. Each student will conclude the study with a culminating research report.

LAND 702. Special Problems in Economic and Community Development **Credit 3 (3- 0)**

Special problems related to economic and community development will be identified. Students will select a topic of interest and conduct a comprehensive study of the problem under the guidance of a graduate faculty member.

LAND 703. Mixed-Use Development **Credit 3 (3-0)**
This course deals with planning and development of mixed use projects. Topics of discussion will include place making, feasibility studies, financing, planning and design issues, marketing and management. Applicable regulatory issues will be studies as well.

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 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. Pre-requisites OSH 416 .

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 630. Industrial Safety MCNC **Credit 3 (3-0)**
This course is an in-depth OSHA certification

OSH 632. Design of Engineering Hazard Controls **Credit 3(2-2)**
This course is an overview of the design and assessment of engineering controls for the abatement of health and safety hazards in the work-place. An emphasis is placed on cost benefit analysis, and technical and financial feasibility. Topics of discussion ~~include~~ include industrial noise abatement, industrial ventilation, machine guarding, and walking and working surfaces. Prerequisite: OSH 416.

OSH 637. Machine and Welding Safety **Credit 3 (3-0)**
This course covers the general safety practices and precautions that all welders and safety professionals should follow during welding procedures. Topics such as health factors, ventilation, hot-work management, safe practices and personal protective equipment are covered. Further, hazards related to welding such as: electrical shock, arc radiation, air contamination, fire and explosion and compressed gasses are studied. Pre-requisites OSH 32 and PHYS 226.

OSH 642. Electrical Safety **Credit 3 (3-0)**
This course is an overview of the identification and control of the fire and electrocution hazards of electrical wiring and equipment. An emphasis is placed on the National Electric Code and electrical standards of the Occupational Safety and Health Administration found in the Code of Federal Regulations. Pre-requisites OSH 312 and PHYS 226.

OSH 655. Systematic Approaches to Emergency Management **Credit 3 (3-0)**
This course introduces students to the dynamics of management practice and provides them with a wide variety of management techniques available to them as emergency management professionals. In addition, it will help participants gain an integrated picture of the management process as well as the skills required for effecting organizational change, increasing managerial and service efficiency, implementing program improvements and establish systems for program evaluation. Pre-requisite OSH 210 or consent of the instructor.

OSH 656. Impact of Disaster on Cultures and Communities **Credit 3 (3-0)**
This course is designed to equip the student with an overview of emergency management, focusing on the effects of disasters on different populations, and the current disaster response measures in place. The class structure is based on

the lifecycle of emergency management: mitigation, preparedness, response and recovery. Pre-requisite OSH 210 or consent of the instructor.

OSH 658. Disasters and Emergency Management Policies **Credit 3 (3-0)**
This course examines the structure and missions of local, state, national and international emergency management agencies and their relationships with public safety and voluntary organizations and other regulatory agencies. It also discusses current theoretical and practical approaches to disasters and to emergency management programs. Pre-requisite OSH 210 or consent of the instructor.

OSH 659. Values and Ethics for Administrative Decision Making **Credit 3 (3-0)**
This course will provide students with a comprehensive understanding of the major traditions of ethical reflection and the implications for the emergency manager. Students will be challenged to clarify and reflect critically on their values and ethical standards. Pre-requisite OSH 210 or consent of the instructor.

OSH 660. Risk Management and Boiler Safety **Credit 3 (3-0)**
This course provides a comprehensive study of risk management and boil safety including concepts, methodologies and applications. It includes systematic approaches to risk identification, risk modeling, risk impact assessment, response planning, and documentation. Also, international risk management and risk management organization will be discussed. Pre-requisite OSH 210 or consent of the instructor.

OSH 670. Research Methods in Occupational Safety & Health **Credit 3 (3-0)**
This course provides students with tools to research emergency and disaster management problems as diverse as the social aspects of hurricane evacuation, behavior change in employee emergency preparedness program and applying a cost dimension to traditional risk assessment. Students will also learn to apply quantitative and qualitative research methods from a range of disciplines, such as sociology, psychology, political science, public administration, and criminal justice to contemporary and traditional emergency management problems. Pre-requisite OSH 210 or consent of the instructor.

OSH 672. System Safety and Other Analytical Methods **Credit 3 (3-0)**
This course is an overview of system theory and process safety management. An emphasis is placed on regulatory compliance with the process safety management standard of the Occupational Safety and Health Administration. Topics of discussion include fault tree analysis, failure modes, and risk analysis and management. Pre-requisites: MATH 224 and OSH 411.

OSH 678. Experiential Education I **Credit 3 (3-0)**
To satisfy the requirements of this course, students must engage in cooperative activities within industry, governmental agencies, or in consulting firms. Work responsibilities must include significant hazard assessment activities. Conditions of experience are supervised by departmental faculty.

OSH 679. Experiential Education II **Credit 3 (3-0)**
To satisfy the requirements of this course, students must engage in intern activities within industry, governmental agencies, or in consulting firms. Work responsibilities must include significant hazard assessment activities. Conditions of experience are supervised by departmental faculty.

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 in 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 related to the safety and health profession. Pre-requisite OSH 210 or consent of the instructor.

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.

OSH 788 Master Comprehensive Exam **Credit 0(0-0)**
This course is the comprehensive exam for MSIT/OSH students.

Directory of Faculty

Horlin Carter, Sr., **Associate Professor**, B.A., Physical Education; Marshall University; M.S. Health & Physical Education, Occupational Safety & Health; Marshall University; Ph.D., Highway Traffic Safety Curriculum, Educational Administration; Michigan State University

Robert B. Pyle, Ph.D., **Professor and Chairperson**, B.A., Industrial Arts (Industrial Technology Concentration), Trenton State College; M.A., Industrial Education, (Construction Concentration), Trenton State College; Ph.D., Administration of Vocational-Technical Education, University of Pittsburgh

Dilip T. Shah, **Associate Professor**, B.E., Mechanical Engineering, College of Engineering, University of Poona, India; M.S. Industrial Technology (Industrial Safety Concentration), Illinois State University; Ph.D., Industrial Engineering (Industrial Hygiene and Safety-Specialty), Texas A & M University

Musibau A. Shofoluwe, **Professor**, B.S. Industrial Technology/Construction, North Carolina A&T State University; M.S., Technology Construction Management, Pittsburgh State University; Doctor of Industrial Technology (DIT), Construction Management Specialization, University of Northern Iowa

Syrulwa Somah, **Associate Professor**, A.A. in Liberal Studies, Fiorello La Guardia Community College, City University of New York; B.S., Occupational Safety & Health, State University of New York; M.S. Liberal Studies, Liberal College, University of Oklahoma; M.S. Healthcare Administration, School of Public Administration, Central Michigan University; Ph.D., Policy Studies in Environmental and Occupation Health, the Union Institute & University

Anthony Graham, Interim Chairperson
Suite 270 Proctor 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 three 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), and instructional technologists-computers (077 licensure).

DEGREES OFFERED

MAT in Elementary Education
MAT in Special Education
MS in Instructional Technology
M.A.Ed. in Elementary Education
M.A.Ed. in Reading

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.

Admission Criteria

Criteria for admission are GRE or MAT scores and an undergraduate GPA of 2.6 or better, "Class A" Certification in the area of study, three letters of recommendation. 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. Prior to registration, the candidate 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 Phase I must have been met. Before a candidate can register for classes in Phase II of the Elementary Education Graduate Program, all the requirements of Phase III must have been met prior to graduation. . The Elementary Education Graduate Program requires a 3.0 GPA and at least three (3) years of teaching experience in the elementary classroom setting for graduation.

MASTER OF ARTS IN EDUCATION (M.A.ED.). IN ELEMENTARY EDUCATION

Phase I

Requirements (15 hours)

CUIN 711 – Research and Inquiry (3)
CUIN 619 – Learning Theory (3)
CUIN 728 – Technology (3)
CUIN 729 – Diversity Issues in K-12 Schools (3)
CUIN 721 – Advanced Methods (3)
ELED 788 – Comprehensive Examination (Core) (0)

Documentation of Approvals

(1) Planning contact
(2) Core Comprehensive Examination Passed
(3) 3.0 GPA
(4) Submission of TPAI from current academic year to Program Coordinator

Phase II: Content and Pedagogy (Complete before beginning Phase 3)

Requirements (24 credit hours)

ELED 750 – Tch/Lrn Multicultural (3)
ELED 751 –Adv. Communications (3)
ELED 752 – Adv. Science (3)
ELED 753 – Adv. Social Studies (3)
ELED 754 – Adv. Mathematics (3)
ELED 755 – Ed. Leadership (3)
ELED 756 – Assessment/Evaluation (3)
ELED 720 – Curriculum Development (3)
ELED 788 – Comprehensive Exam (Specialty Area) (0)

Phase III: Capstone Experience

Requirements (1 hour)

CUIN 999- Capstone Experience (1)
Completion and submission of the NBPTS. Take One Project and Acceptable or above grade on National Board-like Portfolio

Documentation of Approvals
Acceptable or above GRADE on National Board (like) Portfolio or Passing National Boards

MASTER OF ARTS IN EDUCATION (M.A.ED.). in Reading Education

PHASE I : Professional Education Core
CUIN 619 – Learning Theories (3)
CUIN 711 – Research & Inquiry (3)
CUIN 721 – Advanced Methods & Internship (3)
CUIN 728 – Integrating Technology into the K-12 Curriculum (3)
CUIN 729 – Diversity Issues in K-12 Schools (3)
ELED 788 – Comprehensive Examination (0)

Documentation Approvals:

(1) Planning Contract
(2) Minimum 3.0 GPA
(3) Core Comprehensive Examination Passed (ELED 788)

Phase II: Expanding Content & Pedagogical Expertise
(NOTE: Phase 2 must be completed prior to Phase 3) Course Requirement: 24 Semester Hours
READ 755 – Foundations of Reading (3)
READ 736 – Language & Early Literacy Development (3)
READ 756 – Integrating Litarcy in the Content Area (3)
READ 757 – Assessment and Litearcy Instruction (3)
READ 774 – Seminar and Research in Reading (3)
READ 759 – Reading Practicum (3)
READ 735 – Organization and Supervison of Reading Programs (3)

Elective: Choose 1 of the following:
ELED 602 – Language Arts through Children's Literature (3)
ENGL 653 – Teaching English as a Secondary Language (3)
ENGL 710 – Language Arts for Elementary Teachers I (3)
READ 758 – Assessment and Intervention of the Literacy Needs of Struggling Readers (3) or CUIN 731 Advanced Diagnosis in Reading Instruction

Phase III: Documentation of Approvals:
Pass Specialization Comprehensive Examination (PRAXIS Examination-Reading Specialist Test

MASTER OF ARTS IN TEACHING (MAT) IN ELEMENTARY EDUCATION

The Master of Arts in Teaching Degree program is designed for college graduates who have decided to enter the teaching profession, many of whom are lateral entry teachers, teachers changing fields, and prospective candidates who are taking coursework before entering the classroom. The Master of Arts in Teaching will enable prospective teachers who bring content knowledge to the graduate degree the opportunity to develop the knowledge, skills, and dispositions to become excellent teachers.

For further information regarding the MAT Degree Programs, contact your prospective licensure content areas.

Admission to Program

Requirements: Entrance requirements include a minimum 2.6 GPA in undergraduate coursework, completion of perquisite competencies, and a Bachelor degree from an Accredited College/University

Prerequisites: (6 or more hours as needed) Complete before the end of Phase I

SPED 661 Introduction to Exceptionality
INST 605 Computers in Education or Technology Competency

Phase I: Initial Licensure Requirements 27 hours

COURSES	
ELED 610:	Knowledge of the Elementary Learner in the Differentiated Classroom
ELED 611:	Balanced Literacy for Elementary Learners I
ELED 612:	Mathematics Curriculum and Pedagogy I
ELED 613:	Classroom Management
ELED 615:	Balanced Literacy for Elementary Learners II
ELED 616:	Social Studies and Science Curriculum and Pedagogy
ELED 617:	Mathematics Curriculum and Pedagogy II
ELED 618:	Clinical Practices for 21st Century Elementary Classrooms
ELED 619:	Action Research for the Elementary Education Classroom

******* ELED 618-Requires a semester-long full day internship assigned in an elementary classroom setting

BENCHMARK: Minimum 3.0 GPA, Pass PRAXIS II, and receive North Carolina initial teaching license. Candidates must take the GRE and pass an application approval process to advance further in the MAT Phase II.

Phase II: (12 hours) Advanced Studies (MAT coursework) Completion of end of Phase I

Courses in Phase II are currently under revision. Please consult your academic advisor for more details regarding this phase in your plan of study.

Documentation of Approvals: (1) Comprehensive Examination passed; and (2) Master's Comprehensive Portfolio

MASTER OF ARTS IN TEACHING (MAT) IN SPECIAL EDUCATION

Admission to Program

Entrance requirements include a Bachelor degree from a regional accredited college or university and a minimum 2.6 GPA in undergraduate coursework. Candidates must take the GRE and receive admissions into Teacher Education Program.

Prerequisites: (9 or more hours as needed)

- SPED 661 Introduction to Exceptionality
- INST 605 Computers in Education or Technology Competency
- CUIN 619 Learning Theories or any other content specific coursework as needed for academic competency

Phase I: General Curriculum Competencies (Initial Licensure Requirements 27 hours)
COURSES

ELED 612 – Mathematics Curriculum and Pedagogy I (3)
SPED 639 – Literacy Development: Strategies and Instruction for Struggling Readers (3)
SPED 760 – Teaching Students with Learning and Behavior Problems (3)
SPED 748 – Special Education Assessment and IEP Development (3)
SPED 763 – Classroom and Behavior Management in Special Education (3)
SPED 764 – Methods and Curriculum Programming for Students with Exceptional Learning Needs (3)
SPED 670 – Clinical Practice in Special Education (6)
INST 731 – Assistive Technology for Special Needs and English Language Learners (3)

SPED 764 – Methods and Curriculum Programming for Children and Youth with Mild/Moderate Disabilities (3) Internship required

BENCHMARK: Minimum 3.0 GPA, Pass PRAXIS II, complete Special Education Electronic Portfolio, complete an exit interview, and receive North Carolina initial teaching license.

Phase II: (15 hours) Advanced Studies MAT coursework)

Courses in Phase II are currently under revision. Please consult your academic advisor for more details regarding this phase in your plan of study.

At conclusion, student must take an oral and written comprehensive examination and complete a Master's Comprehensive Portfolio (similar to content for National Boards) or complete the Master's Action Research Project.

MASTER OF SCIENCE (M.S.) IN 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 Specialization-Media Coordinator (076)

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
INST 700: Instructional Design
CUIN 728: Integrating Technology across the Curriculum
CUIN 729: Diversity
CUIN 721: Advanced Methods

Benchmark # 1: Core Comprehensive Documentation

Required Content and Pedagogy (21 hours)

INST 680: Cataloging and Media Materials
INST 613: Developmental Media for Children (or)
INST 614: Book Selection and Related Materials for Young People
INST 720: Visual Media
INST 721: Multimedia Development and Evaluation (or)
INST 722: Advanced Internet Uses in Education

INST 741: **Media Center Management**
INST 790: **Internship in Instructional Technology**
INST 791: **Thesis/ Special Project**
Research and Development (See Benchmark # 3)

Benchmark # 2: Satisfactory completion of required content and pedagogy, PRAXIS, 3.0 GPA, Portfolio
Completed required content & pedagogy and 3.0 G.P.A.

Benchmark # 3-Capstone
Thesis or Special Project

<u>Instructional Technology Specialist -Computer Program Concentration (077)</u>
Core Requirements to be completed before Content and Pedagogy Courses (18 hours)
CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
INST 700: Instructional Design
CUIN 728: Integrating Technology across the Curriculum
CUIN 729: Diversity
CUIN 721: Advanced Methods and Internship
Benchmark #1: Core Comprehensive Documentation

Required Content and Pedagogy (21 hours)
INST 725: Technology Facilitation in the Schools
INST 755: Programming in BASIC or
INST 756: Programming in LOGO or
INST 757: Authoring Software
INST 722: Advanced Internet Uses in Education
INST 721: Multimedia Development and Evaluation
INST 768: Computer Lab Supervision and Management
INST 790: Internship in Instructional Technology
INST 791: Thesis/Special Project
Research and Development (See Benchmark # 3)

Benchmark # 2: Satisfactory completion of required content and pedagogy, PRAXIS, 3.0 GPA, Portfolio
Completed required content & pedagogy and 3.0 G.P.A.

Elective Courses (3 hours)
Benchmark #3: Capstone - Thesis or Special Project

<u>Business and Industry Program Concentration</u>
Core Requirements to be completed before Content and Pedagogy Courses (18 hours)
CUIN 711: Research and Inquiry
CUIN 619: Learning Theories
INST 700: Instructional Design
INST 701: Foundations of Instructional Technology
INST 705: Instructional Technology Services for Business and Industry
INST 709: Theory and Methods for the Education and Training of Adult Learners or
ADED 708: Methods in Adult Education
Benchmark #1: Core Comprehensive Documentation

Required Content and Pedagogy (15 hours)
INST 722: Advanced Internet Uses in Education
INST 721: Multimedia Development and Evaluation
TECH 670: Introduction to Workplace Training and Development
INST 790: Internship in Instructional Technology
INST 791 Thesis/ Special Project
Research and Development (See Benchmark # 3)

Benchmark #2: Satisfactory completion of required content and pedagogy, 3.0 GPA, Portfolio

Completed required content & pedagogy and 3.0 G.P.A.

Elective Courses (9 hours)
(You may take approved courses from ADED, TECH or GCT).
Benchmark #2: Portfolio
Benchmark #3: Capstone: Thesis or Special Project

Assistive Technology Concentration

Core Requirements to be completed before Content and Pedagogy Courses (18 hours)

INST 730:	Assistive Technology: Foundation, Theories and Issues
INST 731:	Assistive Technologies for Special Needs and English Language Learners
INST 732:	Assistive Computer Technology
INST 733:	Integrating Assistive Technologies in the K-12 Inclusion Classroom

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-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-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-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-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)

CUIN-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)

CUIN-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)

CUIN-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)

CUIN-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)

CUIN-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)

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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)**

ELED 610 - Knowledge of the Elementary Learner in the Differentiated Classroom **Credit 3(3-0)**
This course is designed to provide candidates with the basic skills for effective classroom teaching. These skills include writing instructional objectives, planning for instruction, developing higher order questions, utilizing effective communication skills, understanding theories of learning and classroom management, and developing effective evaluation methods relative to the differentiated elementary classroom. **Prerequisites: SPED 661, INST 605. (F; S; SS)**

ELED 611 - Balanced Literacy for Elementary Learners I **Credit 3(3-0)**
This course provides a framework for understanding the development of language and literacy in children. It is designed to help students learn to build on what children bring to oral language, reading and writing, and to enhance developmentally appropriate language and literacy activities. **Prerequisites: SPED 661, INST 605. (F; S; SS)**

ELED 612 - Mathematics Curriculum & Pedagogy I **Credit 3(3-0)**
This course is designed to develop the knowledge and skills to effectively teach math concepts to the young child through grade six. Methods will be presented in a developmental sequence that supports children's construction of the concepts essential to understanding mathematics. Specifically, this course will provide elementary education candidates with an activity and project-based exploration of informal geometry in two and three dimensions. **Prerequisites: SPED 661, INST 605, and ELED 610. (F; S; SS)**

ELED 613 - Classroom Management **Credit 1(1-0)**
This course provides the candidates with an opportunity to develop, synthesize, and implement a classroom management plan in their field experience. **(F; S; SS)**

ELED 615 - Balanced Literacy for Elementary Learners II **Credit 3(3-0)**
This course is part 2 of ELED 611 Balanced Literacy I and emphasizes a study of models of teaching the English Language Arts at the elementary level. **Prerequisites: ELED 611. (F; S; SS)**

ELED 616 – Social Studies and Science Curriculum & Pedagogy **Credit 3(3-0)**
This course explores the scope and sequence of the elementary curriculum areas of science, social studies and health. **Prerequisites: ELED 610 (F; S; SS)**

ELED 617 - Mathematics Curriculum & Pedagogy II **Credit 3(3-0)**
This course is designed to develop the knowledge and skills needed to effectively teach math concepts to the young child through grade six. Methods will be presented in a developmental sequence that supports children's construction of the concepts essential to understanding mathematics. **Prerequisites: ELED 612 (F; S; SS)**

ELED 618 - Clinical Practice for 21st Century Elementary Classrooms **Credit 6(6-0)**

A field experience which emphasizes the development and use of teaching strategies, methods, skills, and assessments as they relate to the principles of teaching and learning, and the decision making process. The student will use a variety of teaching strategies, methods, skills, and instructional resources. **Prerequisites: All Phase I Course work (F; S; SS)**

ELED 619 - Action Research for the Elementary Education Classroom Credit 3(3-0)
This course will provide candidates an opportunity to look at the role of teacher as researchers, emphasizing the use of research to inform practice. **(F; S; SS)**

Graduate Student Only

ELED 714 Standards and Accountability in Elementary Education Credit 3 (3-0)
This course will focus on the design and application of appropriate learning assessment strategies that consider the pedagogical intent, state, federal and subject standard, and the diversity of the students. Teaching theory and practice will be viewed in the context of student learning assessment. (F, S, S)

ELED 729 School, Community & Family Collaboration Credit 3 (3-0)
This course is a theory and practice in joining families, communities, and schools in promoting children's learning, development, and success in school. Strengths and needs of families in a diverse, multicultural society, teachers' roles in concert with other disciplines in supporting families and buildings partnerships, and connection with community resources. (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)

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-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)

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)

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)

ELED 788 Comprehensive Examinations
This course is for students taking the Core and Specialty Comprehensive exam.

READING EDUCATION

READ 735, Organization and Supervison of Reading Programs **Credit 3 (3-0)**
This course focuses on administrative acts requisite to the creation and guidance of well-balanced, school-wide reading programs. It includes managing and implementing Reading/Language Arts program in the classrooms. The course is for all school personnel who are in a position to make administrative decisions regarding the school reading program. It incorporates teacher inquiry and presentation of research from participatory action research. (F, S, S)

READ 736, Language and Early Literacy Development **Credit 3 (3-0)**
This course addresses theories on the development of language and literacy of young children. It covers issues relating to instruction as well as the socialization patterns and practices that facilitate learning in young children. In addition, it offers opportunities for the collection,, analysis and interpretations of data from inquiry and participatory action research in the home and schools of early learners. (F, S, S)

READ 755, Foundations of Reading **Credit 3 (3-0)**
This course focuses on the broad field of reading - its goal and nature; its theories; factors affecting it growth; sequential development of skills, attitudes and interests; types of reading approaches; organization and materials in teaching the fundamentals of reading. It incorporates teacher inquiry in to appropriate reading instruction and provides opportunities for classroom participatory action research. (F,S, S)

READ 756, Integrating Literacy in the Content Areas **Credit 3 (3-0)**
This course focuses on the best approach to integrate literacy in content area classrooms. It incorporates research-based practices that emphasize the use of multi-literacies to integrate the communication skills in the content areas. It provides opportunities to improve quality teaching through observation, experimentation and action research in the classroom (F, S, S)

READ 757, Assessment and Literacy Instruction **Credit 3 (3-0)**
This course address assessment and intervention procedures of reading problems. It offers opportunities for candidates to explore and analyze reading research data that report on best practices and findings, relevant to struggling readers. It covers techniques and materials candidates can utilize in assessment and instruction of reading in the classroom and clinical settings. (F,S,S)

READ 758, Assessment and Intervention of the Literacy Needs of Struggling Readers **Credit 3 (3-0)**
This course focuses on advanced issues of current problems, trends and approaches in the teaching of reading to struggling readers. It offers opportunities for the study and interpretation of selected texts useful in understanding and analyzing physiological, psychological, sociological and educational factors related to reading difficulties. It provides practices in the use of appropriate assessment tools to assess the literacy needs of struggling readers. In addition, this course offers opportunities for development of case studies and group analysis based on participatory action research. (F, S, S)

READ 759, Reading Practicum **Credit 3 (3-0)**
This advanced laboratory course focuses on techniques appropriate to assess the literacy needs of struggling readers inclassroom and clinical settings. It provides experiences in diagnosis, instructional planning for remediation, on0going evaluation of reading progress, communication with parents, and the use of authentic literature. It incorporates teacher inquiry and design case studies from participatory research data in classroom settings. (F, S, S)

READ 774, Seminar and Research in Reading **Credit 3 (3-0)**

The course focuses on the evaluation of recent research concerning findings, approaches, innovations and organizations of reading instruction. It includes selected topics for reports and research projects. It provides the forum for candidates' presentations of research projects from inquiry, experimentation , and participatory action research. (F, S, S)

SPECIAL EDUCATION

SPED 639 Literacy Development:Strategies and Instruction for Struggling Readers Credit 3 (3-0)
This course focuses on planning and modifying classroom instruction for students experiencing challenges in acquiring basic literacy skills. Assessment of student strengths and weaknesses to guide instructional decision making use of explicit research-based instructional techniques and implementation of proven comprehensive reading strategies and programs are discussed.

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 Introduction to Exceptionality Credit 3 (3-0)
This course gives an overview of the characteristics of individuals with disabilities along with discussion of essential trends, issues and theories relating to special education and lifespan development. Educational, multi-cultural, humanistic, and legal issues are addressed.

SPED-662. Mental Disability Credit 3 (3-0)
This course is 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)
This course is 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)

SPED 670 Clinical Practice in Special Education Credit 6 (6-0)
This field based course serves as partial fulfillment for the Phase I culminating experience. Candidates are required to teach in a supervised setting with learners in K-12 special education environments under the direct supervision of a mentor teacher and university supervisor. A semester long (minnimum ten week) clinical experience is required in an approved setting.

SPED 748 Special Education Assessment and IEP development Credit 3 (3-0)
This course focuses on culturally responsive assessment, IEP development, state required paperwork and interventions for students with special needs and diverse families.

SPED 760 Teaching Students with Learning and Behavior Problems Credit 3 (3-0)
This course is designed to provide evidence-based strategies to improve the academic and behavioral performance of students with disabilities in inclusive settings. A broad range of academic and behavioral approaches will be discussed, including instructional adaptation and modification, effective collaboration, transition planning and non-violent crisis intervention for disruptive and aggressive students. A 30 hour internship in a supervised setting is required.

SPED 763 Classroom and Behavior Management in Special Education Credit 3 (3-0)

This course is a survey of relevant proven research and techniques that are applicable for positive behavior support systems in learning environments for children and youth. This course will include functional behavioral assessment and intervention planning necessary to effectively manage classroom behaviors of individuals or groups of students with learning and behavioral disabilities to promote success in the learning environment.

SPED 764 Methods andCurriculam Programming for Students with Learning Needs_Credit 3 (3-0)
This course is designed to promote culturally responsive instruction through linking classroom content to students' lives and community experiences in the design and delivery of lesson plans. An array of evidence based strategies will be emphasized. A 60 hour internship in a supervised setting is required.

SPED 765 Teaching Exceptional Strategies for Students in Inclusive Settings Credit 3 (3-0)
This course is designed for both the general and special educator working with special needs students in the inclusive classroom. Effective instructional strategies for diverse learners, consultation and collaborative problem solving techniques, and the cooperative teaching model will be explored. (F, S, S)

SPED 771 Advanced Methods and Internship Credit 3 (3-0)
This course provides experiences special education teacher candidates with supervised teaching experiences in special education. It includes the advanced study of effective teaching strategies as well as the application and practice of methods, techniques and materials. Students enrolled in the course are expected to use advanced communication, collaboration, and consultation techniques to work with children, educators, families, and other human service professionals. (F, S, S)

INST 600 Utilization of Educational Media Credit 3 (2-2)
This course provides students with the philosophical and psychological basis of communications in teaching using media. The course covers methods of selecting and using educational materials effectively in teaching.
Students gain skills in media equipment operation and basic media preparation. Students practice, plan and present an instructional session. (F, S, S)

INST 605 Computers in Education Credit 3 (2-2)
This course introduces the students to the various uses and functions of the computer in educational settings. The integration of the computer as a tool for the instructor and student use; and as a tutor for student use in a variety of formats is addressed. A basic introduction to the internet and the World Wide Web is provided. Students also explore different hardware and software configurations. This is not a course for introducing computer use.
(F, S, S)

INST 613 Developmental Media for Children Credit 3 (3-0)
This course entails 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 interest. (F, S, S)

INST 614 Books Selection and Related Materials for Young People Credit 3 (3-0)
This course covers literature, reading interests, and non-text materials for young people. (F, S, S)

INST 680 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 are taught to catalog media by using both traditional and technological methods.
(F, S, S)

INST 700 Instructional Design Credits 3 (3-0)
This course addresses the design, systematic development, implementation, modification and ultimate evaluation of instructional programs. This includes a survey of current research, objectives, outcomes, analysis of concepts, design of instructional sequences and assessment of students performance. (F, S, S)

INST 701 Foundations of Instructional Technology Credits 3 (3-0)
This course provides an overview of the Instructional Technology Field. Students are introduced to some of the significant issues, areas, and practices in Instructional Technology. The history, currently trends, and issues in Instructional Technology and their implementations of education and training are discussed during the course. This course examines the instructional applications of micro-computers and telecommunications in classroom settings. Students are made aware of job opportunities, professional associations, and literature of the profession. (F, S, S)

INST 705 Instructional Technology Services of Business and Industry **Credits 3 (3-0)**
This course introduces students to the impact of technology within business and industry and how learning in that environment warrants instruction and that differs from that of traditional education. Students have the opportunity to (a) investigate various learning and presentation needs of business and industry clients; and (b) to apply different delivery methods, techniques and technological applications to specific audiences in that environment.
(F, S, S)

INST 709 Theory and Methods for the Education and Training for Adult Learners **Credits 3 (3-0)**
This course explores theories and methods that address adult learning. Areas addressed include, but are not limited to, adult motivation, androgogy, assessing adult learning, methods for helping adults learn. (F, S, S)

INST 720 Visual Media **Credits 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 are exposed to various forms of visual media but special emphasis in placed on digital photography and digital video. Principles of analog video editing are explored. New forms of visuals may be included as they are developed. (F, S, S)

INST 721 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 are discussed.
(F, S, S)

INST 722 Advanced Internet Uses in Education **Credit 3(2-2)**
This course explores use of the Internet for the purpose of enhancing instructional activities. Students investigate a variety of resources on the Internet, which can be use for instruction purposes. Students explore the World Wide Web and develop Web-based instruction (F, S, S)

INST 725 Technology Facilitation in the Schools **Credit 3(2-2)**
This course provides students with knowledge, skills, and dispositions to integrate technology into K-12 settings, develop workshops that provide in-service teachers with technology skills and the knowledge to integrate technology in appropriate ways into the curriculum, and provide input into hardware and software related decisions at the school level. (F, S, S)

INST 730 Assistive Technology: Foundation, Theories and Issues **Credit 3(2-2)**
This course will introduce students to the legal and social history related to assistive technologies Assistive Technology, a wide range of theories and models of Assistive Technology, and the current legal and policy directives related to Assistive Technology. Current critical issues in K-12 education and the role of Assistive Technology in addressing those issues will be introduced. Learning disabilities as related to professionally diagnosed difficulties with reading, writing, speaking, listening, spelling, reasoning or math will be discussed.

INST 731 Assistive Technologies for Special Needs /English Language Learners **Credit 3(2-2)**
This course focuses on assistive technologies (AT) and their application in learning contexts, with a special emphasis on English Language Learners and individuals with learning disabilities and behavioral challenges. (AT) for motor impairments, communication disorders hearing impairments, and visual impairments will be introduced. Course participants will also understand the application of Universal Design principles in (AT) use.

INST 732 Assistive Computer Technology **Credit 3 (2-2)**
This course includes an in-depth study of hardware and software solutions and services that classroom teachers can use address learning disabilities and behavioral challenges. Assistive Computer Technologies that can address communication disorders, motor, hearing impairments, and visual impairments will be included. Universal Design for Learning (UDL) principles will be applied in identifying (AT) that can result in multiple means of representation, expression, and engagement for the learner.

INST 733 Integrating Assistive Technologies in the K-12 Inclusion Classroom **Credit 3(2-2)**
This course prepares teachers to apply assistive technologies (AT) including low tech tools to a variety of learning disabilities and behavioral challenges in the inclusion classroom. Teaching strategies and technologies for English Language Learners will also be included. Universal Design principles will be applied in understanding learner needs and in using (AT) to remove barriers to the curriculum. Specific strategies for parental education and involvement will be discussed.

INST 741 Media Center Management **Credit 3(3-0)**
This course provides students with the opportunity to explore different methods for organizing and operating media centers. Students are expected to create plans for media center organization and operation, including budget planning. In addition, students create plans for both student's activities and faculty in –service as related to media center use. (F, S, S)

INST 750 Distance Education **Credit 3(2-2)**
This course provides students with the opportunity to learn about a variety of distance education delivery systems and methods. Different technological configurations are addressed. Students review research on the effectiveness of varied distance delivery systems. (F, S, S)

INST 751 Educational Software Design and Evaluation **Credit 3(2-2)**
This course provides students with the opportunity to apply instructional design techniques and learning theories to the evaluation and development of educational software. During the course students learn storyboarding and use it as a means to create computer-based software. Some limited experiences with authoring software and provided. (F, S, S)

INST 752 Designing Courses for Online Delivery **Credits 3(2-2)**
This course provides students with the knowledge, skills, and dispositions to create interactive online courses that incorporate instructional design principles, learning theory, appropriate use of multimedia and techniques for assessing student learning in the online environment. (F, S, S)

INST 753 Program Evaluation **Credit 3(3-0)**
This course provides students with basic information needed to evaluate educational programs and make recommendations for programs improvement. Students are taught the techniques for evaluation programs and creating program evaluation reports. (F, S, S)

INST 755 Programming BASIC **Credit 3 (2-2)**
The course provides students with the opportunity to learn program logic and structured programming for BASIC. The course includes how plan activities for elementary and mid-level students in programming language appropriate for public school use, is addressed in this course. (F, S, S)

INST 756 Programming in LOGO **Credit 3 (2-2)**
This course provides students with the opportunity to learn program logic and structured programming for LOGO. The course includes how to plan activities for elementary student in programming. LOGO, as a computer programming language appropriate for public school use, is addressed in this course. (F, S, S)

INST 757 Authoring Software **Credit 3 (2-2)**
The course provides students with the opportunity to utilize authoring software to create educational software and presentations. Students import graphics, sounds, 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 enables students to create complex multimedia presentations or complex tutorial educational software. (F, S, S)

INST 758 Emerging Technology for Authoring and Problem Solving **Credit 3 (2-2)**
This course provides students with the opportunity to explore programming, scripting, and other skills as appropriate with emerging or developing programming languages, authoring software, or problem solving technology. In addition, students explore uses within educational contexts and create learning units which incorporate these and other technologies. (F, S, S)

INST 760 Social Foundations of Instructional Technology **Credit 3 (3-0)**
This course explores philosophical, personal, and social issues underlying universal acceptance of the technological revolution. With special emphasis on technology in education and K-12 schools, this course focuses on reasons why we use technology, how it alters the culture of personal and learning situations, the epistemological foundations and worldviews that support or discourage the use of technology, and what it means to learn in a technological-rich learning environment. Participants in the course take part in an introspective dialectic that unfolds through readings, discussions, and personal experiences. (F, S, S)

INST 768 Computer Lab Supervision and Management **Credit 3 (2-2)**
This course provides students with an opportunity to explore different methods for supervising, managing, maintaining, organizing, and operating computer labs in schools. (F, S, S)

INST 770 Independent Study in Instructional Technology **Variable Credit (1-3)**
This course provides the opportunity for students to pursue individual projects(s) and topic (s) of choice with the approval of the instructor. (F, S, S)

INST 771 Special Topics in Instructional Technology **Variable Credit (1-3)**
This course permits the investigation and study of developing areas/topics of concern in the field of instructional technology. (F, S, S)

INST 790 Internship in Instructional Technology **Credit 3 (1-4)**
This course is a professional laboratory designed to provide the student with on-the-job training and direct experiences relating to the professional track she/she has chosen within the program. Students have an opportunity to develop research in an area related to practical experience. (F, S, S)

INST 791 Thesis/ Special Project Research and Development **Credit 3 (3-0)**
This course is used to complete the capstone experience within the Instructional Technology Master's Degree Program. Students are expected to conduct appropriate library research and complete an original project or research during this course. (F, S, S)

INST 799 Special Project/Thesis Continuation **Credit 1 (1-0)**
This course is used to complete the capstone experience within the Instructional Technology Master's Degree Program. Students are expected to conduct appropriate research and complete an original project or research during this course. This course can only be taken after a student has successfully completed INST 791. (F, S, S)

DIRECTORY OF FACULTY

David Boger..**Professor**
B.S., Livingston College; M.S., New Mexico Highlands University; Ph.D., University of New Mexico
Tyrette S. Carter……………………………...**Assistant Professor**
B.A., University of Virginia, M.Ed., Averett College, Ph.D., University of Virginia
W. V. Cobitz ....**Assistant Professor**
B.S., M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University
Elizabeth Jane Davis .... **Associate Professor**
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Dawn C. Waegerle ....**Assistant Professor**
B.A., M.A., Oral Roberts University; Ed.D. College of Williams and Mary
Ereka Williams………………………………………………………………………………Associate Professor
B.S., M.A.; Fayetteville State University; Ph.D., University of North Carolina at Greensboro

Electrical and Computer Engineering

John C. Kelly, Jr., Chairperson
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OBJECTIVE

The Master of Science program in Electrical Engineering provides graduate level education for advanced professional practice or 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 the graduate programs in Electrical Engineering are as follows:

1. To provide master and doctoral levels of study for students who have completed their bachelor's or master's degrees from North Carolina A&T State University, or an ABET accredited, 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 its graduate students.

5. To enrich the undergraduate program as a result of student interaction with high quality engineering faculty who are 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 in government.

7. To foster industrial development in the state and region.

The programs emphasize areas of specialization, which are the current strengths of the department. Thus, the department offers the following four areas of concentration for the graduate programs:

- Computer Engineering
- Communications and Signal Processing
- Electronic and Optical Materials and Devices
- Power Systems and Control

There are other academic programs at the university that are related to the graduate programs in Department of Electrical and Computer Engineering. These programs are important because they include academic subject matter of potential interest to students as supporting courses and areas of minor concentration. Specific supporting master's degree programs include:

- Applied Mathematics, Physics, Chemistry
- Computer Science
- Industrial Engineering
- Mechanical Engineering
- Architectural Engineering
- General (interdisciplinary) Engineering
- Biology
- Environmental Engineering
- Bioinformatics
- Nano Science and Engineering

DEGREES OFFERED

Master of Science - Electrical Engineering
Doctor of Philosophy - Electrical Engineering

ADMISSION REQUIREMENTS

ADMISSION REQUIREMENTS FOR MASTERS DEGREE PROGRAM

A student must first be admitted to the School of Graduate Studies by completing the required application forms and submitting them along with two official copies of their undergraduate and/or graduate transcripts to the School of Graduate Studies. A GRE score is considered for the students from non-ABET accredited institutions. Satisfying the requirements described does not guarantee admission. Students are admitted in three categories:

Unconditional Admission

An applicant may be unconditionally admitted to the Master of Science in Electrical Engineering (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, each applicant must have a 3.0 average in all of his or her engineering courses. International students are strongly recommended to submit the GRE scores to the School of Graduate Studies for the unconditional admission.

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: Applicants must take more than 4 background courses).

b) Applicant who does not have a degree from an ABET accredited curriculum (e.g. international students) did not submit the GRE scores. A minimum GRE score of Verbal + Quantitative = 1100 is required for the unconditional status.

c) Applicant has an overall GPA less than 3.0 in Electrical Engineering, but has a GPA over 2.8.

d) Electrical Engineering student has a GPA less than 2.8 with a 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 status by the School of Graduate Studies.

A provisional student 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 the provisional status to the unconditional status by the School of Graduate Studies through the Graduate Coordinator. Students who fail to have their status upgraded risk not receiving graduate credit for completed graduate courses.

Post-Baccalaureate Studies (PBS)

This category applies to students lacking a baccalaureate degree in engineering, requiring 9-15 hours of prerequisites in general engineering background, or 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. However, the PBS student must not take more than 12 graduate credit hours in Electrical Engineering prior to applying for admission to the MSEE program. No more than 12 graduate credit hours earned in PBS status can be counted in his/her MSEE program.

All graduate students admitted in the Department of Electrical and Computer Engineering must meet with the Graduate Coordinator to obtain information about graduate program. The Graduate Coordinator assists students with registration and course selection until students select a permanent advisor by mutual agreement between the student and the faculty member. Students must select a permanent advisor no more than 9 credit hours into the program usually by the end of the first semester.

ADMISSION REQUIREMENTS FOR DOCTORAL DEGREE PROGRAM

All applications for admission to the Ph.D. program are subject to review by the Graduate Curriculum Development (GCD) 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 or a mismatch in areas of interest may place limitations on the number of students who may be admitted.

Unconditional Admission

The minimum admission requirements for the Ph.D. program are as follows:

1. The student seeking a Doctor of Philosophy Degree in Electrical Engineering 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 the student's graduate performance and potential. The recommendations must be sent to the School of Graduate Studies in sealed envelopes.
5. International students from non-English speaking countries must submit a TOEFL score.

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 in his/her master's degree. (Note: Applicant must have at least a 3.0 overall graduate GPA).

b) 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 complete more than 4 background courses).

These applicants must submit their GRE scores to the Department of Electrical and Computer Engineering. The students in the provisional admission category must obtain 3.0 GPA after 12 credit hours earned in less than a year. Their status will then be changed to the unconditional status after this change is requested through the Graduate Coordinator.

Direct-PhD Programs from B.S Degree

A highly qualified applicant with a bachelors (or equivalent) degree, without an M.S. degree, can apply for the Ph.D. Program. Such students generally shall have a bachelor's degree in electrical/computer engineering from an ABET accredited university, or from an acceptable institution of higher learning that is recognized by the department and the university.:

a) Direct entry into the Ph.D. program shall be contingent upon an earned GPA of 3.5 or higher over the last 60 course credit hours of his/her undergraduate degree.

b) A minimum GRE score of Verbal + Quantitative = 1100 is required for the direct-PhD application.

c) The applicant is advised to establish a relationship with at least one faculty member of the department who agrees to be the student's dissertation advisor.

d) The decision to recommend direct entry into the direct-PhD program shall be made by the Graduate Coordinator with recommendation by two faculty members in the Department of Electrical and Computer Engineering.

e) A prior research experience is required during his/her undergraduate program.

All graduate students admitted in the Department of Electrical and Computer Engineering meet with the Graduate Coordinator to obtain information about Graduate Program. The Graduate Coordinator assists students for registration and course selection until students selects a permanent advisor by mutual agreement between the student and the faculty member. Students must select a permanent advisor no more than 9 credit hours into the program usually by the end of the first semester.

MASTER'S 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 may be taken outside the department, subject to approval by the student's advisory committee.

SELECTION OF ADVISOR

At the beginning of the program, the student meets with the Graduate Coordinator to obtain information about the Graduate Program. The Graduate Coordinator assists the student for registration and course selection until the student selects a permanent advisor by mutual consent. Students must select a permanent advisor no more than 9 credit hours into the program usually by the end of the first semester.

THE ADVISORY COMMITTEE

The advisor and the student form the Advisory Committee for the student's thesis/project before the submission of the Graduate Plan of Study. In general, the student's committee will have a minimum of three members for the thesis option and 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 of this committee will be selected from faculty who have both the time and the interest to assist the particular student. Only one member of the committee may be selected from outside of the department. A co-advisor may 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.

THE PLAN OF GRADUATE STUDY FOR THE MASTER DEGREE PROGRAM

Before the completion of 12 credit hours of course work, the student and his/her advisor must establish the Plan of Graduate Study for the student's master's program and submit the original with signatures of all members of the Advisory Committee to the Department Office with copies to the Graduate Coordinator, the School of Graduate Studies and all committee members. The student must submit the Plan of Graduate Study no later than the completion of 12 credit hours. The Plan of Graduate Study must show the committee chairperson, other committee members, and a chronological list of courses approved by the student's advisor. A committee member's signature on the Plan of Graduate Study denotes their approval of the plan for the student's mater's program. After approval by the Graduate Coordinator, the Plan of Graduate Study becomes the student's official guide to completion of his/her master's degree program.

CHANGE OF ADVISOR AND STUDY PLAN

A student may change his/her advisor at any time through mutual consent. When a student changes his/her advisor, the student must submit a revised Plan of Graduate Study including signatures of the new advisor and all committee members and the consent of the previous advisor. After the submission of a Plan of Graduate Study, a student must resubmit a changed Plan of Graduate Study to the Graduate Coordinator indicating that the plan has been "REVISED" and including the signatures of his/her advisor and all committee members.

TIMING FOR TRANSFERRING TO DIRECT-PhD PROGRAM WITHOUT MASTER DEGREE

A MS student with GPA 3.8 or better after 18 graded course credit hours taken may request to change his/her graduate program from MS to Direct-PhD on recommendation of two faculty members in the department. Such a student who enters the Ph.D. program must take the Qualifying Examination in one and a half year after entering Ph.D. program. A prior research experience is required for the research area in pursuit.

RESEARCH TITLE AND SCOPE APPROVAL FOR THESIS/PROJECT

A research title and scope must be approved by the student's advisory committee for the MS thesis and project options. The thesis/project proposal and the approval must be done at least one semester before the date of the oral defense examination. Thus, a student's advisor must call a proposal meeting where the student presents his/her research proposal with the title and scope. The approval form in Appendix must be submitted to the ECE department office with all committee members' signature.

THESIS/PROJECT ORAL EXAMINATION

The student must present his/her thesis/project work to the Advisory Committee for the thesis or project Oral Examination. In order to schedule the thesis/project Oral Examination, the student must submit an Application for Oral Examination including signatures of all members of the Advisory Committee to the departmental office at least two weeks prior to the date of the Oral Examination. This notification must include the date, time and place of the Oral Examination. The student requesting his/her Oral Examination must distribute a copy of the thesis/project to all members of his/her committee two weeks prior to the date of the Oral Examination. The copy of the application form for the Oral Examination, as approved by the Graduate Coordinator, must be sent to the members of the committee to confirm the approval, date and place. If any committee member cannot attend the scheduled Oral Examination, it must be rescheduled. The location of a thesis/project Oral Examination must be on-campus so that the presentation is accessible to faculty, staff and students.

SUBMISSION OF THESIS/PROJECT

Upon passing the thesis/project Oral Examination, the student must have the thesis approved by the 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 a Thesis, a copy of which may be obtained from the School of Graduate Studies. The student's project report for the project option must be submitted to the departmental office.

SUMMARY OF PROCEDURES FOR THE MASTER'S DEGREE PROGRAM

1. Apply for admission to the School of Graduate Studies.
   (a) The application and all supporting documentation are sent to the School of Graduate Studies.
   (b) The application material includes the followings:
      - The signed application form, application processing fee, letters of recommendation, N.C. residency form (if applicable), acknowledgement card, letter of intent, official transcripts, and other supporting documents
2. Student receives admission decision from the School of Graduate Studies.
3. Student returns the enrollment intention card to the School of Graduate Studies.
4. Student meets with the Graduate Coordinator to obtain information about graduate programs.
5. Student prepares course schedule and registers for classes under the supervision of the Graduate Coordinator.
6. Graduate Coordinator may assign a temporary advisor until a permanent advisor is found.
7. Student selects a permanent advisor no more than 9 credit hours into the program or by the end of the first semester.
8. Student completes the Plan of Graduate Study for the Master's program in consultation with his/her advisor no later than the completion of 12 credit hours including the following:
   - Selection of the Program Option (Thesis, Project, and Course Only)
   - Selection of the advisory committee members according to the program option
   - Course list according to the coursework requirement
   - Signatures of all members of the advisory committee
9. Student submits the original Plan of Graduate Study to the departmental office along with copies to the Graduate Coordinator, the School of Graduate Studies and all committee members no later than the end of the second semester.
10. This Plan of Graduate Study becomes the student's official guide for the student's master's degree program.
11. If a student decides to change his/her Plan of Graduate Study, the student must restart from Step 7 above.
    - The revised Plan of Graduate Study must include the word "REVISED".
12. Student completes all the coursework.
13. For the Thesis/Project options, student schedules the Thesis/Project presentation and defense in consultation with his/her advisor, and submits the Application for Oral Examination to the Graduate Coordinator and the School of Graduate Studies with all signatures from the advisory committee. Upon approval of the request, the student submits the written report for the Project Option or the draft of the thesis for the Thesis Option to all committee members for review at least two weeks prior to the suggested date. The student completes the Thesis/Project presentation and defense.

14. The examination result is sent to the School of Graduate Studies with signatures of all committee members and the Graduate Coordinator within 48 hours.
15. Student submits Application for Graduation to the Graduate Coordinator, and then the Graduate Coordinator submits Final Graduate Clearance Checklist to the School of Graduate Studies.
16. All of the required documentation is submitted to the School of Graduate Studies and the Department Office.
17. The student graduates.

DOCTORAL DEGREE PROGRAM REQUIREMENTS

CREDIT-HOUR REQUIREMENTS AFTER MS DEGREE

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. 600 level courses are not counted in the coursework requirement except for courses related to student's Qualifying Examination. A minimum of 12 credit hours of doctoral dissertation 997, 3 hours of 992, 3 hours of 991 and 3 hours of 995 are required. No more than 6 credit hours at the graduate level in an area outside of electrical engineering may be accepted to satisfy a graduate area concentration. Thus, a total of 45 credit hours are required for the doctoral degree. The student is encouraged to take all courses related to the subjects selected for his/her Qualifying Examination.

CREDIT-HOUR REQUIREMENTS FOR DIRECT-PhD DEGREE

A minimum of 42 hours of graded coursework past the BS degree is required, or a minimum of 24 hours past the MS degree. However, six (6) credit hours must be taken outside of the department. 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, 3 hours of 991 and 3 hours of 995 are required. Thus, a total of 63 credit hours are required for the Direct-PhD degree. The student is encouraged to take all courses related to the subjects selected for his/her Qualifying Examination.

DISSERTATION RESEARCH

There is no limit to the maximum number of dissertation credits for Ph.D. students. However, no more than 12 dissertation credits are counted toward the 45 credit hour requirement described above. A doctoral student can not register dissertation credits before passing the Qualifying Examination.

SELECTION OF ADVISOR

At the beginning of the first semester, each student meets with the Graduate Coordinator for the assignment of an advisor in an area of interest to the student. The Graduate Coordinator assists students with registration and course selection until students select a permanent advisor. By the end of the first semester or the first 9 credit hours for each student, a permanent advisor is 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 in the student's major subject and four other members. The Advisory Committee must include a Representative from the School of Graduate Studies selected from outside of the department in an area not related to the student's dissertation area. The Graduate School Representative is 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 preliminary and final oral examinations, and must sign the reports of the examinations. However, he or she does not 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. More than half of the members must be selected from the Department of Electrical and Computer Engineering. The Advisory Committee may consist of co-advisor. A co-advisor from outside of the department must apply in writing and be approved by the Graduate Curriculum Development (GCD) Committee in the department.

THE PLAN OF GRADUATE STUDY FOR THE DOCTORAL PROGRAM

Before the student completes 12 credit hours of course work, the student and his/her advisor establish the Plan of Graduate Study for the student's doctoral program and submit the original with signatures of all members of the Advisory Committee to the Department Office with copies to the Graduate Coordinator, the School of Graduate Studies and all committee members. The Plan of Graduate Study shows the committee chairperson, other committee members, and a chronological list of courses approved by the student's advisor. A committee member's signature on the Plan of Graduate Study denotes their approval of the plan for the student's doctoral program. After approval by the Graduate Coordinator in the department, the Plan of Graduate Study becomes the student's official guide to completion of his/her doctoral program and the official list of individuals who form the Ph.D. Advisory Committee.

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 "Dissertation"	1/3

CHANGE OF COMMITTEE MEMBERS AND STUDY PLAN

A student may change his/her advisor at any time through a mutual consent. When a student changes his/her advisor, the student must submit a revised Plan of Graduate Study including signatures by the new advisor and all committee members and the consent of the previous advisor. After the submission of a Plan of Graduate Study, a student must resubmit a changed Plan of Graduate Study to the Graduate Coordinator indicating that the plan has been "REVISED" and including the signatures of his/her advisor and all committee members.

Ph.D. QUALIFYING EXAMINATION

The purpose of the Qualifying Examination is to identify students who are qualified to work toward the Ph.D. degree in Electrical Engineering by requiring these students to demonstrate basic competence in a broad range of relevant subjects. Students are not expected to engage in research until they have passed their Qualifying Examination.

Full-time and part-time students with an MS degree must take this examination within two and four years of the admission to the Ph.D. program respectively. The Direct-PhD student must take the examination within the first five academic semesters of the admission to Ph.D. program. A Direct-PhD student who enters the Direct-PhD program from MS program without an MS degree must take the Qualifying Examination in one and a half year after entering Ph.D. program.

Only students with unconditional status can apply for the Qualifying Examination. Any student in provisional status can not sit for the Qualifying Examination. 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 Plan of Graduate 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 Department Office in the middle of each academic semester. The student must apply for the Qualifying Examination by the posted deadline.

The examination consists of a three-hour written examination for each subject and covers two subjects per day in two consecutive days. At the time of registration, the student declares the track in which he or she will be taking the examination. Each student must select only two subjects in his/her concentration area and two subjects from other areas. Students must obtain an overall score of at least 80% to pass the examination. A student who has failed the Qualifying Examination one time is given a second chance to retake the Qualifying Examination within a year. A student whose overall score is below 80% must retake the examination. The student who needs to retake the examination can not change any subjects selected in the first attempt. The Graduate Coordinator will notify each examinee of his or her results by letter within three weeks from the date of examination.

A student who wants to retake the Qualifying Examination must apply the Qualifying Examination by the posted deadline. No student is permitted to take the Qualifying Examination more than twice. A student not recommended for re-examination, or who fails the exam on a second attempt is afforded the opportunity to withdraw from the university. A student who chooses not to withdraw will have his or her graduate program terminated upon completing the semester in which the denial or second failure occurs. Also, a student who fails to take the examination or re-examination at the prescribed time is considered to have taken and failed the examination or re-examination.

FAILURE IN QUALIFYING EXAMINATION FOR DIRECT-PhD

A student who failed the qualifying exams twice is required to withdraw from the graduate program upon completing the semester. Also, a student who fails to take the examination or re-examination at the prescribed time is considered failing the examination or re-examination. However, a Direct-PhD student who failed the examination in good standing may elect to be approved to transfer to the M.S. program for a terminal M.S. degree if they have completed less than six semesters at North Carolina A&T State University.

Ph.D. PRELIMINARY ORAL EXAMINATION

After passing the Qualifying Examination, each Ph.D. student must complete a Preliminary Oral Examination conducted by the student's Advisory Committee, which the representative from the School of Graduate Studies attends. This is an oral examination 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*".

Unanimous approval by the Advisory Committee is required to pass the examination. Approval may be conditioned on satisfactory completion of additional work. In this situation, a student passes the examination when these conditions are met. A student is admitted to candidacy for the Ph.D. degree only upon passing the Preliminary Oral Examination. 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.

The Preliminary Oral 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 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 a Preliminary Oral Examination unless the student's Plan of Graduate Study has been approved by the Graduate Coordinator. The student must be in good academic standing when the request is submitted and when the examination is held.

The student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Department Office at least two weeks prior to the date of the Preliminary Examination. The application form must include the date, time and place of the preliminary examination. The student requesting his/her oral examination must distribute a copy of the written report to all members of his/her committee two weeks prior to the date of the Preliminary Oral Examination. The copy of the application form for the preliminary examination (approved by the Graduate Coordinator) is sent to the student and the members of the committee to confirm the approval, date and place of the examination. If any committee member can not attend a scheduled Preliminary Oral Examination, it must be rescheduled.

Ph.D. FINAL ORAL EXAMINATION

Each Ph.D. student must pass a Final Oral Examination conducted by the student's Advisory Committee, which a representative from the School of Graduate Studies attends. This examination is the final dissertation defense presentation that is scheduled after a dissertation is completed. It consists of the defense of the methodology used and the conclusions reached in the research in the dissertation. 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 is 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 student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Department Office at least two weeks prior to the date of the Final Oral Examination. The application form must include the date, time and place of the Final Oral Examination. The dissertation must be completed and copies of it must be distributed to all members of his/her Advisory Committee two weeks prior to the date of the Final Oral Examination. The copy of the application form for the Final Oral Examination (approved by the Graduate Coordinator) is sent to the student and the members of the committee to confirm the approval, date and place of the defense. If any committee member can not attend a scheduled Final Oral Examination, it must be rescheduled.

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 Department Office.

SUMMARY OF PROCEDURES FOR THE DOCTORAL PROGRAM

1. Apply for admission to the School of Graduate Studies
   a) The application and all supporting documentation are sent to the School of Graduate Studies.

b) The application material includes the following:
   - The signed application form, application processing fee, letters of recommendation, N.C. residency form (if applicable), acknowledgement card, letter of intent, official transcripts, and other supporting documents

2. Student receives admission decision from the School of Graduate Studies.
3. Student returns his or her enrollment intentions to the School of Graduate Studies.
4. Student meets with the Graduate Coordinator to obtain information about graduate programs.
5. Student prepares the course schedule and registers for first semester classes under the supervision of the Graduate Coordinator.
6. Graduate Coordinator may be a temporary advisor until a permanent advisor is found.
7. Student selects a permanent advisor no more than 9 credit hours into the program.
8. Student completes the Plan of Graduate Study for the doctoral program in consultation with his/her advisor during the second semester and includes the following activities in this process:
   - Selection of the advisory committee members. The advisory committee consists of a chairperson in the student's major subject, and four other members.
   - Selection of course list according to coursework requirements. The coursework may include courses in preparation for the Qualifying Examination.
   - Obtaining signatures of all members of the advisory committee
9. Student submits the original Plan of Graduate Study to the Department Office with copies to the Graduate Coordinator, the School of Graduate Studies and all committee members no later than the end of the second semester.
10. This Plan of Graduate Study becomes the student's official guide for the student's Ph.D. degree program.
11. If a student decides to change his/her Plan of Graduate Study, the student must restart from Step 7 above.
12. The revised Plan of Graduate Study must include the word "REVISED".
13. Student takes Qualifying Examination within two years plus one semester of student's admission to the Ph.D. program.
14. Whenever the direction of the student's dissertation topic has been determined in consultation with his/her advisor, the student submits the dissertation title and the outline of the proposed research to the student's Advisory Committee.
15. Student completes all coursework.
16. After passing the Qualifying Examination, and when the proposed research is in a mature stage and is likely to succeed in experimentation, the student schedules the Preliminary Oral Exam in consultation with his/her advisor and forwards the exam schedule to the Graduate Coordinator and the School of Graduate Studies. After their approval, the student and his/her advisor post the time and place of the examination and submit a written report to all committee members including the representative from the School of Graduate Studies for their review at least two weeks prior to the examination date.
17. The examination result is sent to the School of Graduate Studies in 48 hours and if the examination has been passed without conditions, the student is admitted as a "*Ph.D. Candidate*".
18. At least one semester (or four months) of "*Ph.D. Candidacy*", the student schedules the Final Oral Examination in consultation with his/her advisor. The student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Graduate Coordinator at least two weeks prior to the date of the Final Oral Examination. Upon approval of this request, the student and his/her advisor must post the time and place of the exam and submit a copy of the draft of his/her dissertation to all committee members including the representative from the School of Graduate Studies for their review by two weeks prior to the suggested date.
19. The examination result is sent to the School of Graduate Studies with signatures of all advisory committee members and the in 48 hours.
20. Student submits Application for Graduation to the Graduate Coordinator, and then the Graduate Coordinator submits Final Graduate Clearance Checklist to the School of Graduate Studies.
21. Student submits all required documentation to the School of Graduate Studies and the Department Office.
22. The student graduates.

SUMMARY OF COURSE OFFERINGS

The 600 level courses numbered 600-699 are open to qualified seniors and graduate students. Courses numbered 700 and above are only open to graduate students.

- ELEN-685, 785 and 885 are experimental courses that are being used to create new courses. Only one special topic among ELEN-685, 785, 885 with a title of the topic can be included in the Plan of Study.

- ELEN-x93, x94 and x99 are graded by Pass/Fail, and not counted as coursework requirements.

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 610	Power 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 658	Digital Image Processing Laboratory	2 (1-3)
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 725	Pervasive Computing Systems	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 799	Master Thesis Continuation	1 (0-1)
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 812	RF CMOS Integrated Circuits	3 (2-3)
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 991	Doctoral Qualifying Examination	3 (0-3)
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)
ELEN 999	Doctoral Thesis Continuation	1 (0-1)

DESCRIPTION OF GRADUATE COURSES
Under the Master's 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)**
This course is an introduction to principles and methods of power electronics. Subjects covered are semiconductor devices and their complementary components and systems, different static switching converters like AC to DC AC to AC, DC to DC and DC to AC converters and their applications. Pre-requisite: ELEN-320 or consent of instructor.

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 or consent of instructor.

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. 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-400 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 or consent of instructor.

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-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-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 ABEL™ 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, delta-sigma data converters and mixed analog-digital layout techniques will be introduced. Prerequisite: ELEN-629 or consent of instructor.

ELEN-725. Pervasive Computing Systems **Credit 3 (3-0)**
This course is a study of Pervasive Computing (a.k.a. Ubiquitous Computing) which is the integration of computer technology into day-to-day life in a seamless manner. This course will address accepted design and implementation approaches relevant to this field, including those used for wearable computing, smart devices, intelligent environments, context aware

computing, and user interfaces and interaction models. A course project will be assigned. Prerequisite: ELEN-621 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.

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 advisor.

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: Master standing and Consent of advisor.

ELEN-799. Master Thesis Continuation **Credit 1 (0-1)**
The course is for Master's students who have completed all required course works and all Master Project or Thesis credits. This optional course assists the student in maintaining full-time enrollment following completion of the Masters Project, ELEN796 or Masters Thesis, ELEN797. The course may be taken to allow time for the student to complete the final project or thesis write-up and to prepare for the masters project or thesis defense. Prerequisite: Completion of all required course works and master project or thesis credits for Master standing students and 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-812. RF CMOS Integrated Circuits **Credit 3 (2-3)**
This course covers the design of RF CMOS integrated circuits. Passive and active RF components and their modeling using modern CAD tools, high-frequency circuit design techniques, noise analysis and RF circuits such as low-noise amplifiers (LNA), mixers, voltage-controlled oscillators (VCO), power amplifiers, and wireless transceiver architectures will be presented. Prerequisite: ELEN-608 or consent of instructor.

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 discusses, 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 Lyaunov'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-991. Doctoral Qualifying Examination **Credit 3 (0-3)**
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. This course is for students who are preparing for and taking the written qualifying examination. Prerequisite: Doctoral student and consent of advisor.

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/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.

ELEN-999. Doctoral Dissertation Continuation **Credit 1 (0-1)**
The course is for doctoral students who have completed all required course works and all dissertation credits. This optional course assists the student in maintaining full-time enrollment following completion of the Doctoral Dissertation, ELEN997. The course may be taken to allow time for the student to complete the dissertation write-up and to prepare for the dissertation defense. Prerequisite: Completion of all required course works and dissertation credits for Doctoral students and Consent of advisor.

DIRECTORY OF FACULTY

Winser E. Alexander..**Professor and Dean**
B.S. North Carolina A&T State University, M.S., Ph.D. University of New Mexico
Ali Abul-Fadl..**Associate Professor**
B.S., M.S., Ph.D., University of Idaho
Marwan Bikdash..**Professor**
B.S., M.S., Ph.D., Virginia Polytechnic Institute
Eric A. Cheek, Sr. .... **Adjunct Associate Professor**
B.S. Carnegie-Mellon University; M.S., Ph.D. Howard University
Ward J. Collis..**Associate Professor Emeritis**
B.S., M.S., Northwestern University; Ph.D., The Ohio State University
Numan Dogan ....**Professor**
B.S., Karadeniz Technical University, M.S., Polytechnic Institute of New York, Ph.D., University of Michigan
Christopher Doss .... **Associate Professor**
B.S.E.E., M.S.E.E., Ph.D., North Carolina State University
William Edmonson ....**Professor**
B.S., GMI; M.S., Georgia Tech; Ph.D., North Carolina State University
Gregory C. Gilmore..**Adjunct Instructor**
B.S. North Carolina State University; M.S., Georgia Institute of Technology
Corey Graves.. **Associate Professor**
B.S.E.E., M.S.E.E., North Carolina A&T University; Ph.D., North Carolina State University
Abdollah Homaifar..**Duke Energy Eminent Professor**
B.S., M.S., State University of New York-Stony Brook; Ph.D., University of Alabama
Shanthi Iyer.. **Research Professor**
B.S., M.S., Delhi University; Ph.D., Indian Institute of Technology
John C. Kelly, Jr. .... **Associate Professor and Chairperson**
B.S., Ph.D., University of Delaware
Jung Kim ....**Professor**
B.S., Yonsei University, M.S., Ph.D., North Carolina State University
Gary Lebby .... **Research Professor**
B.S., M.S., University of South Carolina, Ph.D., Clemson University
Clinton Lee .... **Associate Professor**
B.S., California Institute of Technology; M.S., North Carolina A&T State University; Ph.D., North Carolina State University
Robert Li ....**Professor**
B.S., Duke University; M.S., Purdue University; Ph.D., University of Kansas
Harold L. Martin, Sr. ....**Professor and Chancellor**
B.S. M.S. North Carolina A&T State University, Ph.D. Virginia Polytechnic Institute and State University

David Olson .... **Associate Professor**
B.S., M.E., Michigan Technological University; Ph.D., University of Utah
Alvernon Walker .... **Associate Professor**
B.S.E.E., M.S.E.E., North Carolina A&T University; Ph.D., North Carolina State University
Zhijian Xie..Assistant Professor
B.S., M.S. University of Science and Technology of China, Ph.D. Princeton University
Chung Yu.. **Professor**
B.Eng., McGill University; M.S., Ph.D., The Ohio State University

Electronics, Computer, and Information Technology

http://www.ncat.edu/~ecit

Clay Gloster, Jr., 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; power distribution; and automation and control systems. Additional emphasis is placed on courses in business management, statistical process control, humanities, computer programming, safety and project management, and manufacturing processes to provide students that background they need in the economic and managerial aspects of the business enterprise.

DEGREES OFFERED

Master of Science in Information Technology
Master of Science in Technology Management

ADMISSION REQUIREMENTS

The following documents are to be submitted by applicants for admission to the graduate program in the department.

1. Official transcripts of all post secondary-level academic work.
2. Three recommendations from university faculty or current/former employers.
3. Applicants from foreign universities must submit an official copy of one of the following tests: Graduate Record Examination (GRE), Miller Analogies Test (MAT), or Graduate Management Admission Test (GMAT) directly to the university.
4. Official copy of TOEFL score (if required) mailed directly to the university.
5. Completed application form and application fee stipulated by School of Graduate Studies at N.C. A&T.
6. A "Statement of Purpose" explaining why the student wants to pursue a graduate degree and how the student feels that a graduate degree will help to fulfill their personal career goals.

Master of Science in Information Technology

The Master of Science in Information Technology (major code: 0337) offers three options: the thesis option, the project option and the course work option. The thesis option requires a minimum of 30 semester hours. The project option requires a minimum of 33 semester hours. The course work option requires a minimum of 36 semester hours. The coursework and project options require students to pass two written comprehensive examination. In addition, at least fifty percent (50%) of the credits counted towards the Master of Science in Information Technology degree must be numbered 700 and above and students must maintain and complete the Master of Science in Information 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 CURRICULUM

Program	Option	Foundation Courses	Management Course Electives	Technical Course Electives	Comprehensive Examination Courses	Thesis Courses	Project Course	Total Credits
Information Technology	Thesis	12 credits	6 credits	6 credits	--	6 credits	--	30 credits
	Project	12 credits	6 credits	12 credits	0 credits	--	3 credits	33 credits

	Coursework	12 credits	6 credits	18 credits	0 credits	--	--	36 credits

Foundation Courses	Credit
ITT 700 Project Management for Information Technology	3 (2-2)
ITT 701 Analytical Methods for Information Technology	3 (2-2)
ITT 702 Statistical Methods for Information Technology	3 (2-2)
ITT 703 Technical Research Writing & Communication Skills for Information Techn.	3 (2-2)

Management Course Electives

ITT 620 Telecommunications Management	3 (2-2)
ITT 625 Computer Database Management	3 (2-2)
ITT 685 Ethical issues in Information Technology	3 (3-0)
ITT 730 Systems Integration for Telecommunications Managers	3 (2-2)
ITT 735 Telecommunication Management Issues	3 (2-2)
ITT 740 Regulatory and Policy Issues for Communication Systems	3 (2-2)
ITT 749 Principles of System Administration	3 (2-2)

Technical Course Electives

ITT 601 Wireless Application Protocols	3 (2-2)
ITT 605 Principles of Computer Networking	3 (2-2)
ITT 610 Digital Communications I	3 (2-2)
ITT 611 Digital Communications II	3 (2-2)
ITT 615 Networking Security Applications	3 (2-2)
ITT 629 Computer Networking I	3 (2-2)
ITT 630 Computer Networking II	3 (1-4)
ITT 634 Electronic Instrumentation for Remote Sensing Applications	3 (2-2)
ITT 635 Administration and Security of Wireless Local Area Network I	3 (2-2)
ITT 640 Administration and Security of Wireless Local Area Network II	3 (2-2)
ITT 645 Analysis and Troubleshooting of Wireless LAN Systems	3 (1-4)
ITT 650 Wireless Communication Systems I	3 (2-2)
ITT 655 Optical Communication Systems I	3 (2-2)
ITT 660 Satellite and Personal Communication Systems	3(2-2)
ITT 665 Wireless Geo-location Systems I	3 (2-2)
ITT 670 Communication Circuit Development Laboratory I	3 (1-4)
ITT 675 Video Communication Systems	3 (2-2)
ITT 680 Radio Wave and Optical Signal Propagation	3 (2-2)
ITT 725 Wide Area Networks	3 (3-0)
ITT 729 Introduction to Data Warehousing	3(2-2)
ITT 731 Introduction to Knowledge Discovery in Databases	3(2-2)
ITT 745 Network Services for the Enterprise	3 (3-0)
ITT 746 Telecommunications Network Protocols	3 (2-2)
ITT 747 Secure Wireless and Wired Data Networks	3 (2-2)
ITT 748 Computer Viruses and Malicious Software	3 (2-2)
ITT 750 Computer System Security	3 (1-4)
ITT 751 Introduction to Routing and Switching	3 (1-4)
ITT 752 Advanced Computer Forensics	3 (2-2)
ITT 753 Network Analysis and Performance	3 (2-2)
ITT 754 Advanced Routing Protocols	3 (2-2)
ITT 755 Optical Communication Systems II	3 (2-2)
ITT 756 Protocol Analysis and Implementation	3 (2-2)
ITT 757 Enterprise Security	3 (2-2)
ITT 760 Wireless Communication Systems II	3 (2-2)
ITT 765 Wireless Geo-location Systems II	3 (2-2)

ITT 770 Communication Circuit Development Laboratory II	3 (1-4)
ITT 785 Graduate Internship I	3(0-9)
ITT 786 Graduate Internship II	3(0-9)

Comprehensive Examination Courses

ITT 787 Master's Foundation Courses Comprehensive Examination	0 (0-1)
ITT 788 Master's Management and Technical Courses Comprehensive Examination	0 (0-1)

Project Course

ITT 789 Master's Research Project for Information Technology	3 (0-6)

Thesis Courses

ITT 791 Master's Research Thesis for Information Technology I	1 (0-3)
ITT 792 Master's Research Thesis for Information Technology II	1 (0-3)
ITT 793 Master's Research Thesis for Information Technology III	2 (0-6)
ITT 794 Master's Research Thesis for Information Technology IV	2 (0-6)
ITT 999 Continuation of Project/Thesis for Information Technology	1 (0-3)

Master of Science in Technology Management (MSTM)
School of Technology

The School of Technology's Master of Science in Technology Management (MSTM) program started in about1980's hosted in the Department of Manufacturing Systems, which was entitled as Master of Science Degree in Industrial Technology (MSIT) at that time and changed its title to MSTM in the Spring of 2010. The program was extended to the other three Departments within School of Technology at about 1994. There are seven concentration areas:

MS in Technology Management – Manufacturing (0255)
MS in Technology Management – Electronics and Computer (0251)
MS in Technology Management - Information Technology (0287)
MS in Technology Management - Graphic Communication Systems (0253)
MS in Technology Management - Construction Management (0252)
MS in Technology Management - Occupational Safety and Health (0254)
MS in Technology Management – Environmental and Occupational Safety (0293)

After more than two decades' operation, necessary changes must be made to meet current workforce challenges, and to manage emerging technologies and apply them strategically in the ever changing business environment. The rationales for its title change are as follows:

- Our accreditation body has changed its name from National Association of Industrial Technology (NAIT) to Association of Technology, Management, and Applied Engineering (ATMAE) since January of 2009.
- The term "Industrial Technology (IT)" is no longer acceptable by industries, and it causes confusion with the term "Information Technology (IT)".
- The term "Technology Management" best describes the roles of our graduates in the industries. The jobs that our alumni hold are precisely the management of the production processes, the development and deployment of technology across a broad spectrum of industries.

Admission Requirements
Admission to the Master of Science in Technology Management, within the School of Technology, is based on the undergraduate GPA and other relevant exam scores. For the students whose undergraduate major cannot match the selected area of study within MSTM concentration areas, he/she may be conditionally admitted, requiring to take some undergraduate courses in the selected area. The number of undergraduate courses will be determined by corresponding Department.

Program Objectives

The MSTM degree program is built upon the competencies achieved at the baccalaureate level in the technology curricula and thus enables students to secure application-oriented technology-management positions in today's industrial environment. Specifically, this program is designed to prepare technology-management professionals and enhance their proficiencies in the following areas:

- Planning, organizing and management of technology, people, and resources;
- Applying and controlling the use of various high-level technologies, e.g., information based business management systems, such as, enterprise resource planning systems, supply chain management systems, manufacturing execution systems, etc.; computer aided drafting, design and manufacturing; computer-integrated manufacturing; graphic communications systems; telecommunications and wireless communications; and machine vision and photonics.
- Construction planning and scheduling, project management, cost estimating and project management and control systems.
- Occupational safety and health assessments, safety management and control systems.
- Control processes to improve quality, reliability, and productivity.
- Human resource management and the development of a changing workplace to achieve organizational goals.
- Problem solving and creative thinking skills.

Target Audience and Career Opportunities

This program is designed to serve the diverse needs of people who are interested in pursing careers in technology management. Included in this group are the following:

- People currently employed in the management positions that have professional growth aspirations;
- Individuals recently completing their undergraduate study and want additional preparation prior to embarking on a career in technology management positions;
- Students interested in entering an advanced graduate degree program (i.e. Ph.D. in Technology Management) 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 technology innovation, development and deployment of new technologies across a broad spectrum of industries, planning, problem solving, and decision-making. Additionally, the program is designed to enhance student competencies in the areas of research and scholarly writing.

Program Requirements

Total of 33 credit hours is required to receive an MSTM Degree. 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 program must maintain a minimum graduate GPA 3.0 or higher for all semesters. A student who received two "C" grades will be suspended, and a plan of action is required for re-admission. There are two options – Project Option and Thesis Option. The Program Curriculum is as follows.

Master of Science in Technology Management (MSTM)
PROGRAM CURRICULUM

Core Courses (12 credit hours)	**Credits**
MSIT 600 Graduate Seminar	1
MSIT 701 Leadership and Technological Innovations	2
MSIT 702 Enterprise Resource Planning Systems	3
MSIT 703 Statistics and Probability in Industrial Technology	3
MSIT 704 Research Methods for Technology	3

Management Course - (6 credit hours)

The specific courses will be determined by corresponding Department.

Technical Electives - (6 credit hours for thesis option; 9 credit hours for project option)

The specific courses will be determined by corresponding Department.

Required Courses- *Select either Non-Thesis or Thesis Option*

Project Option **(6 credit hours):**	
MSIT 750 Internship	3
MSIT 789 Master's Project	3
Thesis Option **(9 credit hours):**	
MSIT 705 Statistics and Probability for Research	3
MSIT 791 Research for Master's Thesis I	3
MSIT 792 Research for Master's Thesis II	3
Required Examination- (0 credit hours)	
MSIT 788 Master's Comprehensive Examination	0

Total Credit Hours: 33

ELECTRONICS AND COMPUTER TECHNOLOGY
TECHNICAL ELECTIVES

(Student is to select Technical Elective courses from any department within the School of Technology or, with prior approval, any department at North Carolina A&T State University.)

General Technology Specialization:	Credit
ECT 685 Energy, Power and The Environment	3 (3-0)
ECT 690 Special Problems in Electronics and Computer Technology	3 (3-0)
ECT 695 Alternate Energy Systems	3 (3-0)
ECT 699 Independent Study in Electronics & Computer Technology	3 (3-0)
ECT 759 Special Topics in Electronics & Computer Technology	3 (3-0)

Computer Information Technology Specialization:

ITT 629 Computer Networking I	3 (2-2)
ITT 630 Computer Networking II	3 (1-4)
ITT 725 Wide Area Networks	3 (3-0)
ITT 745 Network Services for the Enterprise	3 (3-0)
BUED624E-Commerce Design and Implementation	3 (3-0)

Telecommunications Technology Specialization:

ITT 601 Wireless Application Protocols I	3 (2-2)
ITT 610 Digital Communications I	3 (2-2)
ITT 611 Digital Communications II	3 (2-2)
ITT 650 Wireless Communication Systems I	3 (2-2)
ITT 655 Optical Communication Systems I	3 (2-2)
ITT 660 Satellite and Personal Communication Systems	3 (2-2)
ITT 665 Wireless Geo-location Systems I	3 (2-2)
ITT 670 Communication Circuit Development Laboratory I	3 (1-4)
ITT 675 Video Communication Systems	3 (2-2)
ITT 680 Radio Wave and Optical Signal Propagation	3 (2-2)
ITT 755 Optical Communication Systems II	3 (2-2)
ITT 760 Wireless Communication Systems II	3 (2-2)
ITT 765 Wireless Geo-location Systems II	3 (2-2)
ITT 770 Communication Circuit Development Laboratory II	3 (1-4)

Microelectronics and Materials Technology Specialization:

ECT 614 Microelectronic Fabrication Technology	3 (1-4)
ECT 615 Introduction to Semiconductor Manufacturing Equipment Technology	3 (1-4)
ECT 616 Applied Materials, Semiconductor, Superconductivity	3 (2-2)
ECT 617 Advanced Solid State Devices	3 (2-2)
ECT 714 Advanced VLSI, Film, and IC Process Technology	3 (3-0)

Control and Systems Technology Specialization:

ECT 600	Electromechanical Systems Analysis	4 (4-0)
ECT 634	Electronic Instrumentation for Telemetry Applications	3 (2-2)
ECT 635	Analysis and Design of Mechatronic Systems	3 (1-4)
ECT 640	Electronic Automated Testing Systems	3 (2-2)

INFORMATION TECHNOLOGY
TECHNICAL ELECTIVES

(Student is to select Technical Elective courses from any department within the School of Technology or, with prior approval, any department at North Carolina A&T State University.)

Computer Technology Specialization	**Credit**
Software Systems:	
BUED 624 E-Commerce Design and Implementation	3 (3-0)
CUIN 760 Programming in BASIC	3 (2-2)
CUIN 761 Programming in LOGO	3 (2-2)
GCS 632 Graphic Animation	3 (2-2)
INEN 625 Information Systems	3 (3-0)
Networking:	
ITT 605 Principles of Computer Networking	3 (2-2)
ITT 629 Computer Networking I	3 (2-2)
ITT 630 Computer Networking II	3 (1-4)
ITT 635 Administration and Security of Wireless Local Area Networks I	3 (2-2)
ITT 640 Administration and Security of Wireless Local Area Networks II	3 (2-2)
ITT 645 Analysis and Troubleshooting of Wireless LAN Systems	3 (1-4)
ITT 725 Wide Area Networks	3 (3-0)
ITT 745 Network Services for the Enterprise	3 (3-0)
Security:	
ITT 615 Networking Security Applications	3 (2-2)
COMP 620 Information, Privacy and Security	3 (3-0)
COMP 627 Wireless Network Security	3 (3-0)
Animation/Graphics:	
GCS 632 Graphic Animation	3 (2-2)
ITT 601 Wireless Application Protocols	3 (2-2)

Telecommunications Technology Specialization

Digital:	
ITT 610 Digital Communications I	3 (2-2)
ITT 611 Digital Communications II	3 (2-2)
Wireless:	
ITT 601 Wireless Application Protocols	3 (2-2)

ITT 635	Administration and Security of Wireless Local Area Network I	3 (2-2)
ITT 640	Administration and Security of Wireless Local Area Network II	3 (2-2)
ITT 645	Analysis and Troubleshooting of Wireless LAN Systems	3 (1-4)
ITT 650	Wireless Communication Systems	3 (2-2)
ITT 655	Optical Communication Systems	3 (2-2)
ITT 660	Satellite and Personal Communication Systems	3 (2-2)
ITT 665	Wireless Geo-location Systems	3 (2-2)
ITT 755	Optical Communication Systems II	3 (2-2)
ITT 760	Wireless Communication Systems II	3 (2-2)
ITT 765	Wireless Geo-location Systems II	3 (2-2)

Systems:

ITT 670	Communication Circuit Development Laboratory I	3 (1-4)
ITT 675	Video Communication Systems	3 (2-2)
ITT 680	Radio Wave and Optical Signal Propagation	3 (2-2)
ITT 770	Communication Circuit Development Laboratory II	3 (1-4)

COURSE DESCRIPTIONS

ELECTRONICS AND COMPUTER TECHNOLOGY

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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: ECT 360. **(F;S;SS)**

ECT 645. Power Electronics I **Credit 3(2-2)**
This course addresses the principles and applications of Power Electronics. Topics include power semiconductor switches, phase-controlled rectifiers, DC-to-DC converters, DC-to-DC inverters, motor drives, and power quality. Prerequisites: ECT 314 and ECT 355 or Graduate Standing. **(F;S;SS)**

ECT 681. Power System Analysis and Control **Credit 3(3-0)**
This course covers the development of methods for power system analysis and control. An analysis and implementation of systems for steady state, transient, and dynamic conditions will be studied. Digital solutions will be emphasized. Prerequisite: ECT 355. **(F;S;SS)**

ECT 682. Controls and Applications of Electric Machines **Credit 3(3-0)**
This course will cover the dynamics and control of different applications of electric machines, such as DC machines, synchronous machines, polyphase induction machines and fractional horsepower machines. This course will investigate the dynamics and control of electric machines driven by electronic power converters. Prerequisite: ECT 355. **(F;S;SS)**

ECT 683. Electric Power Quality for the Digital Economy **Credit 3(3-0)**
This course will cover the causes, consequences and solutions of power quality problems that affect the operation of computerized processes and electronic systems. This course will discus the industry standards, monitoring techniques and economic consideration of power quality issues. Prerequisite: ECT 355. **(F;S;SS)**

ECT 684. Energy and Environmental Policy **Credit 3(3-0)**
This course covers the development and current status of energy sources, technologies, consumption patterns, conservation and energy policies. The course will place emphasis on the environmental effects of various choices made at each step of the energy cycle. The course will also examine those choices from technological and socioeconomic points of view. Prerequisite: ECT 355. **(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 686. Energy Management and Environmental Impact in the Energy Market **Credit 3(3-0)**
The purpose of this course is to provide state-of-the-art education in the field of power generation and energy utilization in a deregulated competitive energy services market. 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 717. Special Problems in Electronics and Computer Technology **Credits 3(0-6)**
This course involves the study of a special problem not addressed by an existing course in the department. Typically, a problem is selected from within a new or evolving area in the field. Prerequisite: Approval of Departmental Chairperson. **(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. Prerequisite: 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 764. Graduate Independent Study **Credits 3(0-6)**
This is an independent study in which the graduate student selects a problem (technical or managerial) in consultation with a faculty member in an area related to Electronics Technology or Computer Technology, 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)**

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. Prerequisite: 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. Prerequisite: 24 credit hours of graduate level courses. **(F;S;SS)**

ECT 793. Master's Supervised Teaching I **Credits 2(0-4)**
This course introduces the master's student to laboratory teaching under the supervision of a faculty mentor. Master's students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Topics include laboratory planning, writing learning objectives, teaching pedagogy, characteristics of good teachers, and formative and summative assessment techniques. Prerequisite: Consent of Advisor. **(F;S;SS)**

ECT 794. Master's Supervised Teaching II **Credits 2(0-4)**
This course continues the student's laboratory teaching experience under the supervision of a faculty mentor. Master's students who serve as teaching assistants or as instructors are required to take this course during the second semester they teach. Topics include laboratory planning, writing learning objectives, teaching pedagogy, characteristics of good teachers, and formative and summative assessment techniques. Prerequisites: Consent of Advisor and ECT 793. **(F;S;SS)**

ECT 795. Master's Supervised Teaching III **Credits 2(0-4)**
This course completes the student's laboratory teaching experience under the supervision of a faculty mentor. Master's students who serve as teaching assistants or as instructors are required to take this course during the third semester they teach. Topics include laboratory planning, writing learning objectives, teaching pedagogy, characteristics of good teachers, and formative and summative assessment techniques. Prerequisites: Consent of Advisor and ECT 794. **(F;S;SS)**

COURSE DESCRIPTIONS

INFORMATION AND TELECOMMUNICATION TECHNOLOGY

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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisites: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 organization's operating requirements. Prerequisite: 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. Prerequisite: ITT 635. **(F;S;SS)**

ITT 646. Wireless Computer Networking I **Credit 3(2-2)**
This course covers a broad range of wireless computer networking topics including Wi-Fi, Bluetooth, WiMAX, ZigBee, and infrared wireless technology. The course covers wireless technologies and standards, hardware and software installation, radio frequency (RF) fundamentals, and wireless applications support and security. Prerequisite: ECT 350. **(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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 684. Introduction to Optical Information Processing **Credit 3(2-2)**
This course covers modern wave optics including the application of Fourier transforms to image analysis, optical spatial filtering, and image processing. Prerequisite: ECT 350 or Permission of Instructor. **(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)**

ITT 688. Microwave and Radar Systems Analysis **Credit 3(2-2)**
This is an advanced course in microwave and radar systems analysis with application to airborne and navigation systems. Prerequisites: ECT 314, ECT 350. **(F;S;SS)**

ITT 689. Antenna Systems Technology **Credit 3(2-2)**

The course provides knowledge in general properties of antennas, the electromagnetic theory behind their operation, and an overview of different antenna systems. Equal weight is placed on the electromagnetic aspects important for antenna design and on systems aspects. Among the systems discussed are radar, cellular, and adaptive antenna systems. Prerequisite: ECT 350. **(F;S;SS)**

GRADUATE

ITT 700. Project Management for Information Technology Professionals **Credit 3(2-2)**
This course covers project life cycle, planning templates, project deliverables, project work breakdown structure, estimating resources and task costs, Gantt charts, PERT techniques, project team duties and responsibilities, project team management techniques, and software tools for large projects. Prerequisite: Graduate Standing. **(F;S;SS)**

ITT 701. Analytical Methods for Information Technology **Credit 3(2-2)**
This course covers analytical methods that are critical in the selection and performance analysis of information systems and networks, as well as applications. Prerequisite: Graduate Standing. **(F;S;SS)**

ITT 702. Statistical Methods for Information Technology **Credit 3(2-2)**
This course covers statistical methods that are critical in the selection and performance analysis of information systems and networks, as well as applications. Prerequisite: Graduate Standing. **(F;S;SS)**

ITT 703. Technical Research Writing and Communication Skills for Information Technology **Credit 3(2-2)**
This course covers written and oral communications skills relevant to Information Technology (IT) management topics. It also covers ethical methods of IT research and analysis. Prerequisite: Graduate Standing. **(F;S;SS)**

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 746. Telecommunications Network Protocols **Credit 3(2-2)**
This course covers access control, framing, network protocols, transport protocols, subnetting, port numbers, hubs, switches, routers, and other topics. Prerequisite: Graduate Standing. **(F;S;SS)**

ITT 747. Secure Wireless and Wired Data Networks **Credit 3(2-2)**
This course is designed to provide students with the foundation needed to understand the problems of network security and perform a risk analysis to ascertain the threats and costs of an attack. The course will also discuss how to design and implement security strategies to effectively build a defense to minimize the effects of these attacks. Prerequisite: ITT 746. **(F;S;SS)**

ITT 748. Computer Viruses and Malicious Software **Credit 3(2-2)**
This course involves the study of malicious software (malware) including computer viruses, worms, and Trojan horses. The course covers the various mechanisms used in the construction of malicious software; existing commercial anti-virus software; preventative and reactive means for dealing with malicious software on workstations, servers, and in networks; training and education of users; and reliable sources to monitor for alerts as well as the prevention of hoaxes. Prerequisite: ITT 746. **(F;S;SS)**

ITT 749. Principles of System Administration **Credit 3(2-2)**
This course introduces students to fundamental computer network system administration topics and technologies. Topics covered in the course include ethics and computer network system administration, the law and computer network system administration, and the role of the computer network system administrator in an organization. Prerequisite: ITT 746. **(F;S;SS)**

ITT 750. Computer System Security **Credit 3(2-2)**
This course discusses computer network security at the enterprise level. The course covers issues such as liability, exposure, opportunity, and ability to exploit various weaknesses in a networked computer environment. Prerequisite: ITT 746. **(F;S;SS)**

ITT 751. Introduction to Routing and Switching **Credit 3(1-4)**
This is an intensive laboratory-based course on the establishment of data streams across the Internet. The focus of the course is on providing Transmission Control Protocol/Internet Protocol (TCP/IP) data streams for higher level computer services to operate over an internetwork. Prerequisite: ITT 630. **(F;S;SS)**

ITT 752. Advanced Computer Forensics **Credit 3(2-2)**
This course provides students with knowledge and understanding of computer forensics. The course will also provide a theoretical foundation for the techniques and methods needed for the extraction of information from digital devices. Prerequisite: ITT 746. **(F;S;SS)**

ITT 753. Computer Network Analysis and Performance **Credit 3(2-2)**
This course examines the factors that impact the implementation and performance of computer networks. Students will use simulation tools to design networks based on identified needs, analyze the performance, and investigate the impact of design alternatives. Prerequisite: ITT 746. **(F;S;SS)**

ITT 754. Advanced Routing Protocols **Credit 3(2-2)**
This course examines the routing protocols in standard use and their application in typical enterprise and large Internet service provider (ISP) environments. It also covers the advantages and disadvantages of each protocol, emerging network technologies, and the protocols needed to facilitate their implementation. Prerequisite: ITT 746. **(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. Prerequisite: ECT 655. **(F;S;SS)**

ITT 756. Protocol Analysis and Implementation **Credit 3(2-2)**
This course allows students, using a software package that provides them access to the lowest layers of the Open Systems Interconnection (OSI) model, to write programs to interact with established protocols, and to implement their own network protocols. Prerequisites: ITT 746 and Permission of Instructor. **(F;S;SS)**

ITT 757. Enterprise Security **Credit 3(2-2)**
This course provides students with the advanced concepts needed to establish network security strategies to ensure adequate protection for the corporate environment and provide accessibility for the corporate community. Prerequisite: ITT 746. **(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. Prerequisite: 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. Prerequisite: 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. Prerequisite: ECT 670. **(F;S;SS)**

ITT 787. Master's Foundation Courses Comprehensive Examination **Credit 0(0-1)**
This course will aid in the preparation of the graduate student to take the Master of Science in Information Technology (MSIT) foundation courses examination. The examination will be administered towards the end of the semester or summer session and will be graded on a Pass/Fail basis. Prerequisites: ITT 700, ITT 701, ITT 702, ITT 703 or Permission of Instructor. **(F;S;SS)**

ITT 788. Master's Management and Technical Courses Comprehensive Examination Credit 0(0-1)
This course will aid in the preparation of the graduate student to take the Master of Science in Information 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. Prerequisite: Permission of Instructor. **(F;S;SS)**

ITT 789. Master's Research Project for Information Technology Credit 3(0-6)
The emphasis of this course is on the independent investigation of a problem selected in consultation with the student's graduate committee. A report and successful oral defense before the student's graduate committee is required. Prerequisite: Permission of Instructor. **(F;S;SS)**

ITT 791. Master's Research Thesis for Information Technology I Credit 2(0-4)
The emphasis of this course is on the adequate setup of a thesis problem, collection and use of data, and conclusions. Students must present, in writing, a proposal acceptable to the graduate committee under whose direction the thesis is to be written. Prerequisite: Permission of Instructor . **(F;S;SS)**

ITT 792. Master's Research Thesis for Information Technology II Credit 4(0-8)
This course is a continuation of ITT 791. Students will continue to conduct research and writing of the thesis with emphasis on adequate solution of the problem. Students must present in writing a document acceptable to the graduate committee under whose direction the thesis is to be written. The student will be required to give a successful oral presentation. Prerequisite: ITT 791. **(F;S;SS)**

ITT 999. Continuation of Project/Thesis for Information Technology Credit 1(0-2)
Students who are not enrolled in a course but require the use of university facilities and/or faculty guidance for studies, research, or preparation of a prospectus; project report; thesis; or completing exams must enroll for one credit hour of continuation of project/thesis. Grading of continuation of project/thesis will be either satisfactory (S) or unsatisfactory (U). Prerequisite: Permission of Instructor. (**F;S;SS)**

DIRECTORY OF FACULTY

Dr. Rajeev Agrawal, **Assistant Professor**
B.S., Computer Science, G.B. Pant University, India; M.S., Computer Science and Engineering, Thaper Institute of Engineering & Technology, India; Ph.D., Computer Science, Wayne State University.

Dr. DeWayne Brown, Professor
B.S., Electrical Engineering, University of South Carolina; M.S., Electrical Engineering, North Carolina A&T State University; Ph.D., Electrical Engineering, Virginia Polytechnic Institute and State University.

Dr. Larry Burton, Associate Professor
B.S., Electrical Engineering, M.S., Electrical Engineering, Ph.D., Electrical Engineering, Duke University.

Dr. Fereshteh Fatehi, **Professor**
B.S., Electrical Engineering, Shiraz University, Iran; M.S., Electrical Engineering, Ph.D., Electrical Engineering, Montana State University.

Dr. Clay Gloster, Jr., Professor and Chair
B.S., Electrical Engineering, M.S., Electrical Engineering, North Carolina A&T State University; Ph.D., Computer Engineering, North Carolina State University.

Dr. Claude Hargrove, Assistant Professor
B.S., Computer Engineering, B.S., Electrical Engineering, M.S., Computer Engineering, Ph.D., Biological Engineering, North Carolina State University.

Dr. Ibrahim Kateeb, Assistant Professor
B.S., Physics/Mathematics, University of Science and Technology (Yarmouk University); M.S., Electrical Engineering, Ph.D., Electrical Engineering, North Carolina A&T State University.

Dr. Li-Shiang Tsay, **Assistant Professor**
B.A., Software and Information Systems, M.S., Computer Science, Ph.D., Information Technology, University of North Carolina at Charlotte .

Dr. Yili Tseng, Associate Professor
B.S., Mechanical Engineering, National Taiwan University; M.S., Engineering Science, University of Florida; M.S., Computer Science, Ph.D., Computer Engineering, University of Central Florida.

Dr. Qing-An Zeng, **Assistant Professor**
B.S., Electrical Engineering, Chengdu University of Information Technology, China; M.S., Electrical Engineering, Ph.D., Electrical Engineering, Shizuoka University, Japan.

Energy & Environmental Systems Ph.D. Program

ncatenergy.org

Keith Schimmel, Chair
Energy & Environmental Systems Department
College of Arts & Sciences
Gibbs Hall, Room 301
(336) 285-2329
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 and social aspects of energy and environmental systems.
3. 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 or GMAT verbal and quantitative scores that are no older than 5 years.
3. For applicants whose native language is other than English, Test of English as a Foreign Language (TOEFL) examination written score of at least 550, computer score of at least 213, or internet score of at least 79.

Additionally for international students:

1. Application for the fall semester completed by April 15 and for the spring semester by October 15 is recommended to allow time to obtain visa.
2. International Transcript evaluations are required through WES or ECE.

Students admitted on an unconditional basis are expected to have completed the courses below as part of their prior undergraduate or graduate studies:

Calculus (minimum of ***6*** semester hours)
Physics (minimum of 6 semester hours)
Chemistry (minimum of 3 semester hours)
Computer Programming (minimum of 3 semester hours)

B.S. TO Ph.D. ADMISSION REQUIREMENTS

Students with B.S. degrees in a science, engineering, technology, or economics discipline and with superior credentials (general program admission requirements plus GPA>3.5, strong GRE scores, and strong reference letters) may apply for B.S. to Ph.D. admission.

DEGREE REQUIREMENTS

For students entering with a M.S. degree, the program requires 52 credit hours beyond the M.S. degree distributed as follows:

28 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 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	13	EES 700, EES 730, *EES 711*, *EES 712** + one from EES 710, EES 720, **EES 740** or EES 750
Written Qualifying Examination	0	EES 991, Covers core courses
Elective Track**	9	***Progressive series of courses at the 700-level or 800-level***
Supervised Teaching/Practicum	3	EES 990, EES 993 or EES 996
Seminar Requirement	3	EES 992
Technical Electives**	6	Courses at the 700-level or 800-level, Subject to advisor approval
Preliminary Examination	3	*EES 995*
Dissertation	15	*EES 997*
TOTAL	**52**	

**** Students are advised that 711 is only taught in the Fall, and 712 is taught in the Spring.***
***A minimum of three 800-level courses taken in these two groups must be part of the student's academic program.*

For students entering with a B.S. degree, the program requires 75 credit hours beyond the B.S. degree distributed as follows:

48 credit hours for course work,
6 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 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	***13***	*EES 700, EES 730, EES 711, EES 712 + one from EES 710, EES 720, **EES 740** or EES 750*
Written Qualifying Examination	***0***	***EES 991, Covers core courses only***
Elective Track	***15***	*Progressive series of courses at the 600-level (maximum of two courses), 700-level or 800-level.*
Supervised Teaching/Practicum	***3***	EES 990, EES 993 or EES 996
Seminar Requirement	***6***	EES 992
Technical Electives	***20***	*Courses at the 600-level (maximum of four courses), 700-level or 800-level, Subject to advisor approval*

Preliminary Examination	***3***	*EES 995*
Dissertation	***15***	*EES 997*
TOTAL	***75***	

PROGRAM OPTIONS

CONCENTRATIONS

Atmospheric Sciences: EES 750 and 751 plus at least two of EES 752, 753, 754, 755, 785 (Atmospheric Sciences topic), or 885 (Atmospheric Sciences topic) along with dissertation research in Atmospheric Sciences.

Sustainable Bioproducts: EES 740 plus at least three of EES 741, 742, 743, 744, 785(Sustainable Bioproducts topic), or 885 (Sustainable Bioproducts topic) along with dissertation research in Sustainable Bioproducts.

Energy & Environmental Sciences and Economics: At least four of AGEC 710 (Microeconomics), AGEC 705 (Statistical Methods in Agricultural Economics), AGEC 708 (Econometrics), ECON 701 (Labor and Industrial Relations), ECON 705 (Government Economic Problems), ECON 710 (Economic Development and Resource Use), ECON 720 (Development of Economic Systems), EES 785 (Energy & Environmental Sciences and Economics topic), or EES 885 (Energy & Environmental Sciences and Economics topic) along with dissertation research in Energy & Environmental Sciences and Economics.

TRANSFER OF CREDIT POLICY

The Energy & Environmental Systems Chair with approval of the Dean of the School of Graduate Studies is responsible for determining the applicability of transferred credits to program requirements as presented in the general School of Graduate Studies Transfer of Credit Policies. The amount of credit transferred to an Energy & Environmental Systems degree may never be more than 30% of the required doctoral degree semester hours.

Ph.D. COMMITTEE AND PLAN OF GRADUATE WORK

Initially, the Department Chair will serve as the academic advisor for all new students entering the program. Each student in the Energy & Environmental Systems Department is expected to select a research advisor by the beginning of the second year with the approval of the Chair. The research 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 Ph.D. Committee will consist of a minimum of four (4) graduate faculty members with the research advisor as its chairperson and a School of Graduate Studies representative. The Ph.D. Committee will be recommended by the research advisor, with input from the student, to the Chair of the Energy & Environmental Systems Department, for approval by the Dean of Graduate Studies.

QUALIFYING EXAMINATION

The qualifying examination is a written examination administered after the core courses are completed by a student. The examination covers the core course content. It is prepared and graded by the Energy & Environmental Systems Chair and core course instructors. A 75% mark is required to pass the qualifying examination. A student may retake the exam only once if it is failed. The second attempt at passing the examination must be no earlier than two months after the first attempt. Failure of a student to pass the examination on the second try terminates their work in the program.

PRELIMINARY EXAMINATION

After passing the qualifying examination, a student submits their written dissertation proposal at least ten days before its oral defense to their research advisor, the Chair of the Energy & Environmental Systems Department, and the Dissertation Committee for review. Generally, the preliminary exam should be scheduled during a student’s third semester in the program. Dissertation proposals are expected to include a thorough literature review and a detailed research plan with a timeline and anticipated results. The proposal must be orally defended by the candidate before the Dissertation Committee. Approval by a majority vote of the Dissertation Committee is required to pass the preliminary examination. Approval may be conditioned, however, on the student's meeting specific requirements described by the Dissertation Committee. Failure of a student to pass the examination terminates their work toward the Energy & Environmental Systems degree unless the Ph.D. Committee recommends a reexamination. No reexamination is given until one full semester has elapsed and only one reexamination is permitted. Passing the preliminary examination constitutes approval to proceed with the dissertation research.

ADMISSION TO CANDIDACY

Admission to candidacy for the Energy & Environmental Ph.D. degree 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 completion of the preliminary examination.

FINAL ORAL EXAMINATION

The final oral examination is scheduled after the dissertation is determined to be complete by the research advisor and the Chair of the Energy & Environmental Systems Department and at least two refereed journal articles have either been accepted by the journals or have been approved by the Ph.D. Committee as likely to be accepted. The examination is conducted by the student's Dissertation Committee and consists of the candidate's defense of methodology used and the conclusions reached in the research. Approval by a majority vote of the Dissertation Committee is required to pass the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements described by the Ph.D. Committee. Failure of a student to pass the examination terminates their work in the program unless the Ph.D. 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 and time limit. Additional details of requirements for the program are outlined in the Energy & Environmental Systems Student Handbook available from the Chair of the Energy & Environmental Systems Department.

COURSE DESCRIPTIONS

Energy & Environmental Systems Course Listings

Ph.D. Courses

EES 700 Introduction to Research Ethics
EES 710 Environmental Chemistry
EES 711 Energy & Environmental Economics I
EES 712 Energy & Environmental Economics II
EES 720 Sustainable Energy Systems
EES 730 Research Proposal Writing
EES 740 Fundamentals of Biomaterial Sciences & Bioprocess Systems
EES 741 Biomaterials Characterization
EES 742 Biomass Thermal Conversion Processes
EES 743 Biomass Biological Conversion Processes
EES 744 Environmental and Policy Studies of Biomass Use
EES 750 Physical Meteorology
EES 751 Dynamic Meteorology
EES 752 Climatology
EES 753 Numerical Weather Prediction
EES 754 Advanced Weather Analysis
EES 755 Principles of Air Quality
EES 785 Special Topics
EES 885 Doctoral Special Topics

Ph.D. Level Pass/Fail Courses

EES 990 Doctoral Supervised Practicum
EES 991 Doctoral Qualifying Examination
EES 992 Doctoral Seminar
EES 993 Doctoral Supervised Teaching
EES 994 Doctoral Supervised Research
EES 995 Doctoral Preliminary Examination
EES 996 Laboratory Internship
EES 997 Doctoral Dissertation
EES 999 Continuation of Doctoral Degree

Energy & Environmental Course Descriptions

EES 700. Introduction to Research Ethics **Credit 1(1-0)**
This course will cover the policies regulating research at land grant universities and the ethical principles on which these policies are based. Topics covered include use of humans in research; use of animals in research; research misconduct; authorship and peer review; intellectual property; proper experimental design, data collection, and statistical interpretation; and discipline-specific issues. Prerequisites: Graduate standing and consent of instructor.

EES-710. Environmental Chemistry **Credit 3(3-0)**
This course presents the chemical aspects of applied environmental science. Topics covered include the sources, reactions, transport, and fates of chemical species in water, soil, and air along with the analytical techniques used to study the chemicals. Prerequisites: Graduate standing and consent of instructor.

EES-711. Environmental & Energy Economics I **Credit 3(3-0)**
This course presents theories of natural resource utilization and allocation. Topics covered include externalities, public goods, environmental quality, planning natural resource use and environmental quality, evolution of energy industries, and current energy and environmental regulatory systems. Prerequisites: Doctoral Standing and consent of instructor.

EES-712. Environmental & Energy Economics II **Credit 3(3-0)**
This course presents interrelationships of natural resource use and the environment. Topics covered include applied welfare and benefit-cost analysis, externalities and pollution abatement, and quantitative methodologies for analyzing energy, natural resource, and environmental problems. Prerequisites: EES 711.

EES-720. Sustainable Energy Systems **Credit 3(3-0)**
The course will cover the thermodynamic, mass and energy balance, economic, and environmental considerations of sustainable energy systems. Alternative energy technologies and conventional energy technologies will be compared. Prerequisites: Graduate standing and consent of instructor.

EES 730. Research Proposal Writing **Credit 3(3-0)**
This course will guide the student to prepare a written research proposal that contains a thorough literature review, a clear hypothesis about an issue that has not been resolved in the literature, and appropriate methodologies for determining whether or not the hypothesis is correct. Throughout the course, emphasis will be placed on developing critical thinking and technical writing skills. Prerequisites: Graduate standing and consent of instructor.

EES 740. Fundamentals of Biomaterial Sciences & Bioprocess Systems **Credit 3(3-0)**
This course introduces the science and engineering of converting biorenewable resources into bioenergy and biobased products. Topics covered include the core physical, chemical, and biological principles that underlie the synthesis and modification of biomaterials and associated biopolymers into novel materials. Prerequisites: Graduate standing and consent of instructor.

EES 741. Biomaterials Characterization **Credit 3(3-0)**
This course presents the analytical and spectroscopic techniques and tools available for examining molecular and macroscopic structural features of naturally occurring materials with emphasis on the lignocellulosic substrate. Topics covered will provide an appreciation for the fundamental principles behind the available techniques. Prerequisites: Graduate standing and consent of instructor.

EES 742. Biomass Thermal Conversion Processes **Credit 3(3-0)**
This course presents the available chemical and thermal methods and processes that are available to convert biomass into commodity chemicals and energy as part of a biorefinery concept. Topics covered include the conversion of biomass to specific end products or to complex mixtures of materials such as syngas and pyrolysis oils. Prerequisites: Graduate standing and consent of instructor.

EES 743. Biomass Biological Conversion Processes **Credit 3(3-0)**
This course presents the available biological conversion methods and processes that are available to convert biomass into commodity chemicals and energy as part of a biorefinery concept. Topics covered will highlight the challenges of bioconversions in terms of cost, dewatering, and limited thermal and pH ranges. Prerequisites: Graduate standing and consent of instructor.

EES 744. Environmental and Policy Studies of Biomass Use **Credit 3(3-0)**
This course presents the ways in which biomass technological principles impinge upon policy issues. Topics covered include lifecycle analysis, management issues, public policy development, and principles of green engineering and sustainability. Prerequisites: Graduate standing and consent of instructor.

EES 750. Physical Meterology **Credit 3(3-0)**
This course presents physical principles related to atmospheric environmental systems, processes, and measurements. Topics covered include atmospheric thermodynamics, atmospheric radiation transfer, and cloud microphysical processes. Prerequisites: Graduate standing and consent of instructor.

EES 751. Dynamic Meterology **Credit 3(3-0)**
This course presents classical and physical hydrodynamics. Topics covered include perturbation theory, scale analysis of dynamic equations, atmospheric boundary layers, atmospheric wave motions, the general circulation model, dynamics of tropical convections, middle atmosphere dynamics, atmospheric instabilities, and numerical weather forecasting. Prerequisites: Graduate standing and consent of instructor.

EES 752. Climatology **Credit 3(3-0)**
This course presents physical and chemical principles that influence climate. Topics covered include earth climate history and present-day climate, climate equilibrium, earth energy budget, climate in middle and high latitudes, climate change detection, and future climate scenarios. Prerequisites: Graduate standing and consent of instructor.

EES 753. Numerical Weather Prediction **Credit 3(3-0)**
This course presents the physical and mathematical basis for numerical weather prediction with computer experiments to demonstrate principles and techniques. Topics covered include derivation of sets of prediction equations consistent with scale analysis and dynamical constraints, atmospheric waves and filtered equations, numerical methods and computational instabilities, filtered and primitive equation models, and National Weather Service operational models. Prerequisites: Graduate standing and consent of instructor.

EES 754. Advanced Weather Analysis **Credit 3(3-0)**
This course presents the evolution of physical and dynamic structure of synoptic and mesoscale storm systems occurring in middle and high latitudes. Topics covered include recent advances in understanding these storm systems through intensive field experiments and computer modeling. Prerequisites: Graduate standing and consent of instructor.

EES 755. Principles of Air Quality **Credit 3(3-0)**
This course presents the chemical interactions, transport, and monitoring of trace gas, aerosol, and particulate pollutants in the atmosphere. Topics covered include risk assessment, health effects, regulations, air pollution statistics, estimation of emissions, air quality meteorology, dispersion modeling for non-reactive pollutants, and commonly used air quality models. Prerequisites: Graduate standing and consent of instructor.

EES-785. Special Topics **Variable Credit 2(2-4)**
This course allows the introduction of new topics on a trial basis. The topic of the course will be determined prior to registration. Prerequisites: Graduate standing and consent of instructor.

EES-885. Doctoral Special Topics **Credit 2(2-4)**

This course allows the introduction of new topics on a trial basis at the doctoral level. The topic of the course will be determined prior to registration. Prerequisites: Graduate standing and consent of instructor.

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 faculty. Grading is pass/fail evaluation only. Prerequisites: Doctoral standing and consent of instructor.

EES-991. Doctoral Qualifying Examination **Credit 0(0-1)**
This course will guide the student to take the qualifying examination. The qualifying examination will consist of a written examination over the Energy & Environmental program core courses. Prerequisites: Doctoral standing and consent of instructor.

EES-992. Doctoral Seminar **Credit 1(1-0)**
This course includes presentations delivered by the doctoral students, faculty, and invited speakers on topics related to energy and environmental issues and research. Grading is pass/fail evaluation only. Prerequisite: Doctoral standing.

EES-993. Doctoral Supervised Teaching **Credit 3(1-4)**
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. Prerequisites: Doctoral standing and consent of instructor.

EES-994. Doctoral Supervised Research **Variable Credit 3(3-9)**
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. Prerequisites: Doctoral standing and consent of instructor.

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. Prerequisite: EES 991.

EES 996. Laboratory Internship **Credit 3(0-6)**
This course allows a student to explore various research areas first-hand by performing multiple projects in different laboratories under the mentorship of members of the graduate faculty. It should be taken before a student passes the qualifying exam. Grading is pass/fail evaluation only. Prerequisites: Doctoral standing and consent of instructor.

EES-997. Doctoral Dissertation **Variable Credit 3(3-9)**
This course represents the supervised research leading to the dissertation for the doctoral student. 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. Prerequisite or Corequisite: EES 995.

EES-999. Continuation of Doctoral Degree **Credit 1(1-0)**
This course is a continuation of work toward the doctoral degree. Grading is pass/fail evaluation only. Prerequisites: Doctoral standing.

Graduate Faculty

Program: **Energy & Environmental Systems Ph.D.**
Chair: **Dr. Keith Schimmel**

Jing Zhang, B.S., M.S., Nanjing University; Ph.D., Peking University; Associate Professor
Yuh-Lang Lin, B.S., Fu Jen Catholic University; M.A., Fordham University; M.S., South Dakota School of Mines and Technology; Ph.D., Yale University; Professor
Lyubov L. Kurkalova, B.S., Tajik State University; M.S., Kazakh State University; Ph.D., Iowa State University; Associate Professor

Yevgenii A. Rastigejev, B.S., Moscow Institute of Physics and Technology; M.S., Ph.D., University of Notre Dame; Assistant Professor
Keith A. Schimmel, B.S., Purdue University; M.S., Ph.D., Northwestern University; P.E.; Associate Professor

http://www.ncat.edu/~english/
Elon Kulii, Chairperson
426-A General 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
Master of Arts in Teaching: English Education (Offered in conjunction with the Department of Curriculum and Instruction, School of 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.,the MATand the 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. These 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 with the application 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. In addition, one course is required in each of the following areas: African American literature, American literature, British literature, and one additional course in African American, American, or British literature.

Courses at the 700 level 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 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.

MASTER OF ARTS IN TEACHING: ENGLISH EDUCATION REQUIREMENTS

The M.A.T. in English Education program is housed in the School of Education and administered by the Department of English. The M.A. T. is planned for the college graduate in the respective area seeking licensure and graduate studies in teaching grades K-12. The design of the M.A.T. program is two-tiered. The first tier (Phase I) includes all course work for the A licensure, including an internship requirement and passing appropriate exams of Praxis II. The second tier (Phase II) includes a research requirement and other courses completing requirements for the advanced master's degree and qualifying the candidate for the advanced M licensure. **No courses in Phase II can be taken until all aspects of Phase I and all of the benchmarks are completed (see Curriculum Guide for the M.A.T. in English).**

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 level. The M.A. degree is designed primarily to prepare students for college teaching and for admission to doctoral programs. The M.A.T. in English Education degree enables prospective teachers the opportunity to develop the knowledge to become excellent teachers and helps meet the current critical teacher shortage.

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[1], 650, 652, , 654, 656, 658, 660, 744, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 628, 631, 653, 672, , 701, 703, 704, 705, 706, 707, 709, 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, , 654, 656, 658, 660, 744, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 628, 631, 653, 672, 701, 703, 704, 705, 706, 707, 709, 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, , 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 701, 703, 704, 705, 706, 707, 709
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, , 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 701, 703, 704, 705, 706, 707, 709
6. Thesis Research: ENGL 775 (3 semester hours)

CURRICULUM GUIDE FOR M.A.T. IN ENGLISH EDUCATION

Entrance Requirements: BA from accredited institution; undergraduate GPA of 2.5 or better or passing scores on Praxis I; completing of prerequisite course, Computers in Education.

Phase I (Initial Licensure Coursework): 24 hours:

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[1] In any of these curricula, a course that appears in two categories will count for only one three hour course in one of those categories, i.e. ENGL 631 and ENGL 744.

1. ENGL 652/ ENGL 660
2. ENGL 626
3. ENGL 627
4. ENGL 700-level course to be developed
5. ENGL 721
6. ENGL 755
7. ELED 608
8. Pass Praxis II and be licensed; be employed as a teacher for a minimum of one year before continuing in Phase II or complete 12 semester hours of student teaching; submit GRE scores before continuing Phase II.

Phase II (Advanced Studies Coursework): 15 hours:

1. CUIN 619
2. CUIN 653
3. CUIN 711
4. CUIN 728
5. CUIN 729
6. CUIN 788
7. ENGL 788

Total hours for the program: 39 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	Young Adult Literature
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 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 709	Medieval Literature
ENGL 710	Language Arts for Elementary Teachers I
ENGL 711	Secondary Education: The Classroom as Clinic
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 726	From Pen to Power: Empowerment through Enhancement of Critical Thinking and Writing Behaviors
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. (Fall, Spring)

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 SOCI 603). (Fall, Spring, Summer)

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. (Fall; Spring; Summer)

ENGL 627. Young Adult Literature **Credit 3 (3-0)**
This course acquaints prospective and in-service teachers with a wide variety of good literature that is of interest to young people. Emphases are on thematic approaches to the study of literature, book selection, and motivation of students to read widely and independently with depth and understanding. (Fall, Spring, Summer)

ENGL 628. The American Novel **Credit 3 (3-0)**
This course is a history of the American novel. Emphasis will be on major authors, such as Melville, Wilson, James, Dreiser, Chesnutt, Larsen, Faulkner, Hurston, Wright, Ellison, Morrison, Kingston, and Erdrich.
(Fall, Spring)

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. (Fall, Spring, Summer)

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. (Fall, Spring)

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 Africa 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. (Fall)

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. (Spring)

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 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. (Demand)

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. (Demand)

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. (Demand)

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. (Demand)

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. (Demand)

ENGL 709. 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. (Demand)

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. Secondary Education: The Classroom as Clinic **Credit 6 (0-12)**
This course provides observation and guided student teaching experiences in the high school. Students will provide ninety or more hours of actual teaching under the direct supervision of university and high school professional teachers. The student teacher will be intricately involved in all academic and usual duties of the secondary English teacher.

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. (Demand)

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. (Demand)

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. (Demand)

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. (Demand)

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 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. (Demand)

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)**

Directory of Faculty

Ahmad, Anjail R. ……………………………………………………………**Assistant Professor**
B.A., Agnes Scott College; M.A., New York University; Ph.D., University of Missouri-Columbia
Bonner, Patricia E. ……………………………………………………………**Associate Professor**
B.A., University of Alabama; M.A., Atlanta University; Ph.D., University of South Florida
Brown, Jane G. ……………………………………………………………..**Associate Professor**
B.A., Converse College; M.A., Vanderbilt University; M.A. and Ph.D., University of Dallas
Garren, Samuel B……………………………………………………………….**Professor**
B.A., Davidson College; M.A., Ph.D., Louisiana State University
Greene, Michael ………………………………………………………………….**Professor**
B.A., Duke University; M.A., Ph.D., Indiana University
Kamara, Gibreel M. ……………………………………………………………**Associate Professor**
B.A., M.A., North Carolina A&T State University; Ed.D., Temple University
Kulii, Elon……………………………………………………………………………**Professor**
B.A., Winston-Salem State University; M.S., North Carolina A&T State University; Ph.D., Indiana University
Levy, Michele F…………………………………………………………………………**Professor**
B.A., George Washington University; M.A. and Ph.D., University of North Carolina at Chapel Hill
Meyerson, Gregory D……………………………………………………………….**Assistant Professor**
B.A., Miami University of Ohio; M.A. and Ph.D., Northwestern University
Nieman, Valerie…………………………………………………………………………**Assistant Professor**
B.S., West Virginia University; M.F.A., Queens University of Charlotte
Nwankwo, Chimalum……………………………………………………………**Professor and Chairperson**
B.A., University of Nigeria, Nsukka; M.F.A., M.A., and Ph.D., University of Texas at Austin
Parker, Jeffrey D…………………………………………………………………….**Associate Professor**
B.A., University of North Carolina at Greensboro; M.A., North Carolina &T State University; Ph.D., University of South Carolina
Uwakweh, Pauline………………………………………………………………….**Assistant Professor**
B.A., University of Port Harcourt, Nigeria; M.A., University of Calabar, Nigeria; Ph.D., Temple University.

Family and Consumer Sciences

http://www.ag.ncat.edu/academics/FCS/index.html

Valerie L. Giddings, Chairperson
102 Benbow Hall
(336) 334-7850

OBJECTIVES

The Department of Family and Consumer Sciences offers three graduate degrees leading to a Master of Science and a Master of Arts in Teaching.

The Master of Science in Food and Nutritional Sciences is designed to 1) develop the basic knowledge and skills necessary to undertake research in Food and Nutritional Sciences and other related areas; 2) develop competencies to work as food and nutrition specialists in education, or with other community nutrition agencies and food industries; and 3) obtain theoretical and experimental competencies necessary to pursue additional graduate studies or obtain professional degrees.

The Master of Arts in Teaching in Child Development, Early Education and Family Studies – Birth – Kindergarten prepares students to 1) master the knowledge, skills and dispositions required for the Birth –Kindergarten license; 2) analyze theoretical perspectives and current research, to conduct research and to apply this knowledge toward reflective, evidence-based practice in teaching and working with families; and 3) assume diverse professional and leadership roles in a wide variety of educational and community settings.

The Master of Arts in Teaching in Family and Consumer Sciences prepares students to 1) master the knowledge, skills and dispositions required for the Family and Consumer Sciences license; 2) analyze theoretical perspectives and current research, to conduct research and to apply this knowledge toward reflective, evidence-based practice in teaching and working with families; and 3) assume diverse professional and leadership roles in a wide variety of educational and community settings.

DEGREES OFFERED

Master of Science - Food and Nutritional Sciences
Master of Arts in Teaching – Child Development, Early Education and Family Studies – Birth – Kindergarten
Master of Arts in Teaching – Family and Consumer 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 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 additional graduate level coursework and complete the practicum experience.

For admission to Phase I of the Masters of Arts in Teaching (M.A.T.) program in Child Development, Early Education and Family Studies – Birth – Kindergarten and the Master of Arts in Teaching (M.A.T.) program in Family and Consumer Sciences Education, students must have an earned baccalaureate degree from an accredited institution, completed any required prerequisite courses and have minimum undergraduate grade point average of 2.5 or passing scores on Praxis 1. For admission to Phase II of the M.A.T. program students must have a minimum grade point average of 3.0 in Phase I coursework, passing scores on Praxis II and a Class A license, documentation of one year of successful teaching or a six (6) credit hour student teaching experience with children and families, satisfactory recommendations from the candidate's principal, if teaching, or from three persons knowledgeable of his/her interactions with children and families, completion of the Graduate Record Exam (GRE) or Miller Analogies Test (MAT), and applicant's Essay of Purpose.

OTHER REQUIREMENTS

All applicants for the Masters degree in Food and Nutritional Sciences are required to take and earn a grade of B or better in two basic Food and Nutritional Sciences courses which include one basic Food Science course and one Nutrition course. Admission to candidacy for the M.S. in Food and Nutritional Sciences requires the satisfactory completion of the two basic Food and Nutritional Sciences courses, 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. Degree candidates must successfully complete a comprehensive examination, satisfactory presentation and defense of the thesis (thesis option) and submission of the thesis to the graduate office or completion of a practicum (non-thesis) in order to be approved for graduation.

All students completing the M.A.T. program in Child Development, Early Education and Family Studies – Birth – Kindergarten and the M.A.T. program in Family and Consumer Sciences Education are required to successfully complete a comprehensive examination and a Master's Comprehensive Portfolio and/or complete the Master's Action Research Project.

The Comprehensive Examination in each master's program can be taken once the 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 (700 level and above). All students are required to submit a plan of study prior to the completion of 15 hours of coursework.

CAREER OPPORTUNITIES

A degree in Food and Nutritional Sciences 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.

The M.A.T. program in Child Development, Early Education and Family Studies – Birth – Kindergarten and the M.A.T. program in Family and Consumer Sciences Education prepare students to become teachers, including teachers with provisional (lateral entry) or emergency licensure, teachers seeking licensure in the field, and/or those individuals changing careers. Completion of Phase I qualifies the student for "A" licensure and completion of Phase II qualifies the student for the advanced "M" license. Additionally, graduates are prepared to take leadership roles in school systems or community agencies that are engaged in teaching young children and promoting optimal family development.

Master of Science - Food and Nutritional Sciences
A. Thesis Option - Suggested Curriculum Guide
Requirements:

1. Twelve-Thirteen (12-13) semester hours of Food and Nutrition courses.
   FCS 730 - Nutrition and Disease 3 credits
   FCS 735 - Experimental Foods 4 credits OR
   FCS 715 Trace Elements (3 credits)
   FCS 736 - Research Methods Food and Nutrition 4 credits
   FCS 744 - Seminar in Food and Nutrition 2 credits
   FCS 788 - Comprehensive Examination 0 credit
2. In addition to the above core courses three (3) credit hours of statistics numbered 600 or above are required.
3. Six (6) semester hours in Food and Nutrition and related areas are required.
4. Three (3) semester hours of CHEM 651 Advanced Biochemistry or equivalent.
5. Three (3) semester hours of suggested electives 3 credits
6. FCS 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.
   FCS 730 - Nutrition and Disease 3 credits
   FCS 735 - Experimental Foods 4 credits OR
   FCS 715 Trace Elements and Nutrition 3 credits
   FCS 736 - Research Methods Food and Nutrition 4 credits
   FCS 744 - Seminar in Food and Nutrition 2 credits
   FCS 745 - Practicum in Food and Nutrition 3 credits
   FCS 788 - Comprehensive Examination 0 credit
2. In addition to the above core courses three (3) credit hours of statistics numbered 600 or above are required.
3. Twelve (12) semester hours in Food and Nutrition and

related areas are required.
4. Three (3) semester hours of CHEM 651 Advanced Biochemistry or equivalent numbered 600 or above.
5. Three (3) semester hours of suggested electives.

COURSES - FOOD AND NUTRITIONAL SCIENCES AND RELATED AREAS

FCS 635 Introduction to Research Methods in Food and Nutrition
FCS 637 Special Problems in Food, Nutrition or Food Science
FCS 647 Sensory Evaluation of Foods
FCS 640 Geriatric Nutrition
FCS 641 Current Trends in Food Science
FCS 646 Food Product Development
FCS 658 Community Nutrition
FCS 649 Food Laws and Regulation
FCS 650 International Nutrition
FCS 656 Medical Nutritional Therapy I
FCS 657 Medical Nutritional Therapy II
FCS 644 Food Microbiology & Biotechnology
FCS 654 Nutrition Education
FCS 715 Trace Elements and Nutrition
FCS 730 Nutrition and Disease
FCS 733 Nutrition During the Growth and Development
FCS 734 Nutrition Education
FCS 735 Experimental Foods
FCS 736 Research Methods in Food and Nutrition
FCS 739 Thesis Research
FCS 740 Community Nutrition
FCS 742 Food Culture: Nutrition Anthropology
FCS 744 Seminar in Food and Nutrition
FCS 745 Practicum in Food and Nutrition
AGRI 799 Thesis Research
AGRI 999 Continuation of Thesis

Suggested Elective Courses

AGEC 705	Statistical Methods in Agricultural Economics
ANSC 665	Techniques in Biotechnology
ANSC 615	Selection of Meat and Meat Products
ANSC 617	Physiology of Reproduction of Farm Animals
BIOL 630	Molecular Genetics
BIOL 671	Principles and Practices of Immunology
BIOL 681	Statistical Methods Research
BIOL 690	Introduction to Epidemiology
CHEM 651	General Biochemistry
COMP 600	Special Topics in Computer Science
CUIN 617	Computers in Education
SOCI 617	Research Methods II
CUIN 776	Independent Reading in Education II
CUIN 777	Independent Reading in Education III
CUIN- 790	Seminar in Education Problem
LASC 636	Principles of Toxicology

COURSES WITH DESCRIPTION IN FAMILY AND CONSUMER SCIENCES

Food and Nutritional Sciences
Advanced Undergraduate and Graduate Courses

FCS-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.

FCS-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.

FCS-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: FCS-357.

FCS-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.

FCS-644. Food Microbiology and Biotechnology **Credit 3(1-4)**
A survey of selected topics in food microbiology and the impact of biotechnology on food production. The course will cover the metabolic pathways, organisms, genetic tools and processes involved with food production from fermented dairy products, vegetables, fruits and meats. Prerequisites: BIOL 220, FCS 245.

FCS-645. Special Problems in Food Administration **Credit 2 (0-4)**
Individual work on special problems in food administration.

FCS-646. Food Product Development **Credit 4 (2-4)**
A course which provides experiences in the development and testing of recipes. Opportunities will be provided for demonstrations, writing and photography with selected business. FCS 245, FCS 357, FCS 542, FCS 545

FCS-647. Sensory Evaluation of Food **Credit 3 (2-2)**
A study of the color, texture, aroma and flavor or foods by the use of diverse and innovative sensory evaluation methods. Prerequisites: FCS-245, FCS-357, Math 224.

FCS 649. Food Laws and Regulations **Credit 3 (3-0)**
Federal and state laws and regulations affecting food production processing, packaging, marketing, and distribution of food and food products. Prerequisites: FCS 245, FCS 357, FCS 443.

FCS-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.

FCS-654. Nutrition Education **Credit 3 (3-0)**
This course covers the philosophy, principles, methods and materials involved in nutrition education. The application of nutrition knowledge and skills in the development of the nutrition education curriculum and programs in schools and communities are implemented.
Prerequisites: FCS 150, FCS 357; students must be advanced undergraduate or graduate level.

FCS 656 Medical Nutrition Therapy I **Credit 4 (4-0)**
This course is designed to provide the student with the knowledge and skills for assessment of the nutritional status of individuals. Students will develop nutrient-based care plans for persons with various disease conditions. Prerequisites: FCS 554, CHEM 251, CHEM 252

FCS 657 Medical Nutritional Therapy II **Credit 4 (4-0)**
This course is a student 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 anddiet modification in the treatment of diseases. Prerequisite: FCS 656.

FCS-658. Community Nutrition **Credit 3 (2-2)**
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: FCS-654.

GRADUATE STUDENTS ONLY

FCS-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: FCS 357, CHEM 651

FCS-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: FCS-554 or equivalent.

FCS-733. Nutrition During Growth and Development **Credit 3 (2-2)**
Nutritional, genetical and environmental influences on human growth and development.
Prerequisite: FCS-554 or equivalent.

FCS-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: FCS 357.

FCS-735. Experimental Foods **Credit 3 (2-2)**
Objective and subjective evaluation of food, development and testing of recipes, and experimentation with food.
Prerequisite: FCS-245 or equivalent.

FCS-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.

FCS-739. Thesis Research **Credit 3 (0-6)**
Research problems in food or nutrition.

FCS-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: FCS 357.

FCS-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: FCS 357.

FCS-744. Seminar in Food and Nutrition **Credit 2 (2-0)**
Required of all graduates in Food and Nutrition.

FCS-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.

FCS-788. Comprehensive Examination **Credit 0**
Student must sign up for this course in the semester that they will take the Comprehensive Examination.

AGRI 799. Thesis Research **Variable Credit 3-9 (3-0 repeatable)**
Supervised research related to the student’s thesis topic approved by his/her graduate thesis advisor. Prerequisites: 15 hours of graduate credit and departmental approval required.

AGRI 999. Continuation of Thesis **Variable Credit 1-6 (1-0 repeatable)**
This course is for master’s students who have completed all required credit hour requirements. Grading is pass/fail evaluation only. Prerequisite: AGRI 799 or completion of all thesis credits.

PROGRAM OF STUDY FOR THE MAT IN CHILD DEVELOPMENT, EARLY EDUCATION AND FAMILY STUDIES

Prerequisites (12 hours or more as needed)

CUIN 617	Computers in Education
CUIN 625	American Public Education
	or
CUIN 701	Philosophy of Education
FCS 611	Child Development: Prenatal through Middle Childhood
SPED 660	Introduction to Exceptional Children

PHASE I: Initial Licensure (24 hours)

CUIN 619	Learning Theories
FCS 710	Assessment and Evaluation of Family & Consumer Sciences
FCS 701	Individual & Family in a Contemporary Society
FCS 629	Applied Principles of Infant/Toddler Curricula or equivalent
FCS 639	Applied Principles of Preschool Kindergarten Curricula or equivalent
FCS 659	Fundamentals of Emergent Literacy
	Or
CUIN 623	Teaching Reading through Primary Years
FCS 702	Advanced Methods/Internship

Phase II: Advanced Studies Coursework (15 hours)

CUIN 728	Integrated Technology in the K-12 Curriculum
FCS 700	Multicultural Perspectives in Child and Family
FCS 704	Advanced Seminar in Family and Consumer Sciences
FCS 711	Research & Inquiry in Family and Consumer Sciences
FCS 713	Early Childhood Leadership and Professional Development
FCS 788	Comprehensive Examination

Phase I and Phase II Total Hours = 39

COURSES in CHILD DEVELOPMENT, EARLY EDUCATION AND FAMILY STUDIES and RELATED AREAS

FCS 611	Child Development: Prenatal through Middle Childhood
FCS 629	Applied Principles of Infant/Toddler Curricula
FCS 639	Applied Principles of Preschool Kindergarten Curricula
FCS 659	Fundamentals of Emergent Literacy
FCS 700	Multicultural Perspectives in Child and Family
FCS 701	Individual & Family in a Contemporary Society
FCS 702	Advanced Methods/Internship
FCS 704	Advanced Seminar in Family and Consumer Sciences
FCS 710	Assessment and Evaluation of Family & Consumer Sciences
FCS 711	Research & Inquiry in Family and Consumer Sciences
FCS 713	Early Childhood Leadership and Professional Development
FCS 788	Comprehensive Examination
CUIN 617	Computers in Education
CUIN 619	Learning Theories
CUIN 623	Teaching Reading through Primary Years
CUIN 625	American Public Education
CUIN 701	Philosophy of Education
CUIN 728	Integrated Technology in the K-12 Curriculum
SPED 660	Introduction to Exceptional Children

COURSES WITH DESCRIPTION IN FAMILY AND CONSUMER SCIENCES

Child Development, Early Education and Family Studies – Birth-Kindergarten
Advanced Undergraduate and Graduate Courses

FCS 611. Child Development: Prenatal through Middle Childhood Credit 3
This course will focus on the advanced study of the child's cognitive, social-emotional, linguistic, physical, and adaptive development through an analysis of theory and research. A sociocultural framework will inform this study of child development.

FCS 629. Applied Principles of Infant/Toddler Curricula Credit 3
This is designed to link child development theories, assessment, and classroom practices for infants, toddlers, and young children, birth to age three, and their families. A major emphasis of this course is to prepare students to plan, implement, and evaluate developmentally, individually, and culturally appropriate child care practices, teaching strategies, and learning environments for infants, toddlers, and young children with and without disabilities. Students will apply content knowledge, skills, and dispositions in a field-based experience.

FCS 639. Applied Principles of Preschool Kindergarten Curricula Credit 3
This course focuses on the study of child development and early childhood education principles, materials, and evaluation measures underlying recommended practices and experiences for the typical and atypical development of children 3-5 years old. Special emphasis will include goals and objectives, activity plans, daily routines/schedules, use of assessment information, teacher-made materials, inquiry questioning techniques, and use of technology. Simulated teaching activities and a field-based experience are required.

FCS 659. Fundamentals of Emergent Literacy Credit 3
This course explores current research, theory, strategies, and resources that enable students to acquire theoretical and practical knowledge to design research-based literacy activities and environments. Topics explored include the social context of literacy learning; stages of language and literacy development; roles of families in supporting literacy development; cultural and linguistic similarities and differences; English language learners; performance-based assessment; and adaptations for children with special needs.

FCS 700. Multicultural Perspectives in Child and Family Credit 3
This course examines the way that group and individual differences and similarities shape the purposes and practices of educational programs and policies. Also included will be an investigation of the social foundations of multicultural education and exploration of issues pertaining to teaching and learning methods that are responsive to diverse learners and incorporate families in the educational process.

FCS 701. Individual & Family in a Contemporary Society Credit 3
This course will focus on the multiple theoretical approaches to understanding family functioning, priorities and concerns within the context of a diverse society. This course will also address the profession's role in promoting optimal family functioning. Prerequisites: FCS 611, SPED 660 or Approval by the instructor.

FCS 702. Advanced Methods/Internship Credit 6
This course provides advanced supervised teaching experience in a classroom setting with a focus on applying developmental theory and research. Students will demonstrate a mastery of planning, implementing and evaluating teaching and learning strategies that are developmentally and culturally appropriate. Prerequisites: Approval of major department.

FCS 704. Advanced Seminar in Family and Consumer Sciences Credit 3
This course will examine issues, trends and initatives at the local, state, national and international levels. Prerequisite: Completion of Phase I or Approval of Instructor.

FCS 710. Assessment and Evaluation of Family & Consumer Sciences Credit 3
This course investigates formal and informal methods of assessing student learning including observational techniques and standardized measures. Students will be able to select and interpret assessment measures and to use observational and assessment data to plan and modify teaching methods and curricula. National trends in assessment will be examined. Prerequisites: FCS 611, SPED 660.

FCS 711. Research & Inquiry in Family and Consumer Sciences **Credit 3**
This course provides examination of current research in Child, Family, & Consumer Sciences. Introduction to social sciences research methods, analysis of research reports and other professional papers. Students will develop, conduct, and present a research project. Prerequisites: Completion of Phase 1 or Approval of Instructor.

FCS 713. Early Childhood Leadership and Professional Development **Credit 3**
This course examines a variety of theoretical models of leadership, leadership roles and personal leadership styles. Topics will include problem analysis, collaboration, conflict resolution, group facilitation. effective communication and reflective practice. Dispositions and strategies for valuing, supporting and sustaining life long learning through personal and professional growth will be explored. Prerequisites: Completion of Phase 1.

FCS 788. Comprehensive Examination **Credit 0**
Students must register for this course in the semester that they will take the Comprehensive Examination.

PROGRAM OF STUDY FOR THE MAT IN FAMILY AND CONSUMER SCIENCES

Prerequisites (as needed)
CUIN 624- Teaching Reading in the Secondary School

Phase I: Initial Licensure (24 hours)
Required Coursework:
CUIN 619- Learning Theories
CUIN 625- Theory of America Public Education

Choose two of the following courses:
- FCS 682- Advanced Interior Design
- FCS 684- Family Financial Management
- FCS 683- Consumer Behavior in Fashion
- FCS 679- Nutrition Education

FCS 681- Curriculums and Instructional Planning in Family and Consumer Sciences
FCS 700- Multicultural Perspectives in Child and Family
FCS 702- Advanced Methods and Internship in Family and Consumer Sciences

Phase II: Advanced Studies Coursework (15 Hours)
FCS 701- Individual & Family in a Contemporary Society
FCS 704- Advanced Seminar in Family & Consumer Sciences
FCS 710- Evaluation & Assessment in Family & Consumer Sciences
FCS 711- Research and Inquiry in Family & Consumer Sciences
CUIN 720- Curriculum Development
FCS 788- Comprehensive Examination

Family and Consumer Sciences
Advanced Undergraduate and Graduate Courses

FCS 682- Advanced Interior Design **Credit 3**
This course will address the current aspects of interior design. Topics to be covered include certification laws, fire-safety and abrasions resistance requirements for furniture and fabrics, accommodations for universal access, and issues of environmentalism. Stylistically, the course will address neoornamentalism, post modernism, and deconstructionism. Additionally. students will be made aware of new composite materials, acoustic controls, and lighting types. Prerequisites: Consent of Instructor.

FCS 681- Curriculums and Instructional Planning in Family and Consumer Sciences **Credit 3**
This course addresses the need for planning programs in education. The course covers teaching objectives, curriculum models, evaluation of family and consumer sciences programs, use of advisory groups, organizations, and use of resources and facilities. Prerequisites: Consent of Instructor.

FCS 683- Consumer Behavior in Fashion **Credit 3**

This course is the study of how the consumer's world is influenced by the actions of fashion marketers and how fashion marketers are influenced by consumers. Marketing and consumer behavior theories and concepts as they apply to fashion will be discussed. Results of research studies will be used to illustrate marketing and consumer behavior theories and concepts. Students will gain an understanding of how fashion shapes the everyday world of consumers. Prerequisites: Permission of Instructor.

FCS 684-Family Financial Management **Credit 3**
This advanced course focuses on the integration of family financial management behavior and decision making over the life cycle. Effects of public policy on household financial decisions and interrelationships between management behavior and the labor market will be examined. Prerequisites: Consent of Instructor.

FCS 700. Multicultural Perspectives in Child and Family **Credit 3**
This course examines the way that group and individual differences and similarities shape the purposes and practices of educational programs and policies. Also included will be an investigation of the social foundations of multicultural education and exploration of issues pertaining to teaching and learning methods that are responsive to diverse learners and incorporate families in the educational process.

FCS 701. Individual & Family in a Contemporary Society **Credit 3**
This course will focus on the multiple theoretical approaches to understanding family functioning, priorities and concerns within the context of a diverse society. This course will also address the profession's role in promoting optimal family functioning. Prerequisites: FCS 611, SPED 600 or Approval by the instructor.

FCS 702. Advanced Methods/Internship **Credit 6**
This course provides advanced supervised teaching experience in a classroom setting with a focus on applying developmental theory and research. Students will demonstrate a mastery of planning, implementing and evaluating teaching and learning strategies that are developmentally and culturally appropriate. Prerequisites: Approval of major department.

FCS 704. Advanced Seminar in Family and Consumer Sciences **Credit 3**
This course will examine issues, trends and initatives at the local, state, national and international levels. Prerequisite: Completion of Phase I or Approval of Instructor.

FCS 710. Assessment and Evaluation of Family & Consumer Sciences **Credit 3**
This course investigates formal and informal methods of assessing student learning including observational techniques and standardized measures. Students will be able to select and interpret assessment measures and to use observational and assessment data to plan and modify teaching methods and curricula. National trends in assessment will be examined. Prerequisites: FCS 611, SPED 600.

FCS 788. Comprehensive Examination **Credit 0**
Students must register for this course in the semester that they will take the Comprehensive Examination.

DIRECTORY OF FACULTY

Mohamed Ahmedna .... **Professor CEPHT**
B.S., Institut Agronomique et Veterinaire Hassan II; M.S., Ph.D., Louisiana State University
Valerie L. Giddings..Associate Professor and **Chairperson**
B.S., Bennett College; M.S., Ph.D., Virginia Polytechnic Institute and State University
Ipek Goktepe .... **Associate Professor**
B.S., University of Istanbul; M.S., Ph.D.; Louisiana State University
Thurman Guy .... **Associate Professor**
B.S., M.S., North Carolina A&T State University; M.S., University of Wisconsin; Ed.D., University of North Dakota
Salam A. Ibrahim..**Professor**
B.S., University of Mosul; M.S., University of Georgia; Ph.D., University of Kentucky

Sung-Jin Lee..**Assistant Professor**
B.S., Chungnam National University; M.S Chungnam National University; M.S. , Ph.D. Virginia Polytechnic Institute and State University.
Chantel Lumpkin…………………………………………………………………………Assistant Professor
B.F.A., Bradley University; M.A., Oral Roberts University; M.A. Loyola Marymount University; Ph.D., Michigan State University
Patricia A. Lynch..**Assistant Professor**
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B.S., North Carolina A&T State University; M.Ed., University of North Carolina Greensboro; Ph.D., Virginia Polytechnic Institute and State University
Claudette Smith ....**Cooperative Extension Faculty**
B.S., North Carolina A&T State University; M.S., Ph.D., Ohio State University
Celvia E. Stovall...**Associate Administrator**
B.S., Central Michigan University; M.S., Louisiana State University; Ph.D., University of Minnesota
Rosemarie Vardell ....**Assistant Professor**
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Jane Walker .... **Associate Professor**
B.S., Appalachian State University; M.S., Virginia Polytechnic Institute and State University; Ph.D., University of North Carolina at Greensboro
Meeshay Williams-Wheeler ....**Assistant Professor**
B.S., University of North Carolina at Greensboro; M.S., North Carolina Central University; Ph.D.University of North Carolina at Greensboro

FACULTY EMERITI

Harold E. Mazyck..**Professor**
B.S., South Carolina State College; M.A., New York University; Ph.D., University of North Carolina at Greensboro
Chung W. Seo...**Professor**
B.S., M.S., Korea University; Ph.D., Florida State University
Carolyn S. Turner..**Professor**
B.S., M.S., University of North Carolina at Greensboro; Ph.D., Virginia Polytechnic Institute and State University

Graphic Communication Systems and Technological Studies

Dr. Brenda S. Faison, Chairperson
116 Price Hall
(336) 334-7550
http://schooloftech.ncat.edu/graphic-communication-systems-and-technological-studies.html

OVERVIEW

The Department of Graphic Communication Systems and Technological Studies offers three master's degrees: the Master of Science in Technology Education, the Master of Science in Technology Management (the concentration in graphics), and the Master of Art in Teaching for Technology Education. The Master of Science in Technology Education with concentrations in Technology Education, Teaching; Trade and Industrial Education, Teaching; Workforce Development Director; Training and Development for Industry provides experiences with advanced concepts, technologies, research, and strategies for the preparation of advanced teacher/practitioners. The Master of Art in Teaching for teachers of technology and trade and industrial education provides teachers with an initial license in Phase I of the degree and an advanced license upon completion of the degree. These programs comply with INTASC, NCATE, and the North Carolina Department of Public Instruction, and the standards of achievement for 21^{st} Century learners.

These programs 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. Both degree programs are currently undergoing revisions mandated by the North Carolina Department of Public Instruction. The Master of Science in Technology Management helps students with technical and technological backgrounds gain technology management skills and knowledge so they will perform more effectively on the job in technology related organizations. This degree also offers some technical upgrade and development with three to four technical electives.

DEGREES OFFERED

Master of Science - Technology Education
Concentrations: Technology Education, Teaching
Trade and Industrial Education, Teaching
Workforce Development Director
Training and Development for Industry

Master of Art in Teaching
For Teachers of: Technology Education
Trade and Industrial Education

Master of Science in Technology Management (Graphics Concentration)

GENERAL PROGRAM REQUIREMENTS

Admission Criteria

Criteria for admission are GRE or MAT scores and an undergraduate GPA of 2.6 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 nor is such a license required for admission into the Master of Art in Teaching.

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: (l) 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.	3 sh
	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)	0 sh

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)	0 sh

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 666	Technological Education Teaching Methods and Internship
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: 40

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.

Master of Arts in Teaching for Technology Education
For teachers of: Technology Education, Teaching*
Trade and Industrial, Teaching

Phase I Courses

CUIN 619 Learning Theories	3 hours
CUIN 624 Teaching Reading in the Secondary School	3 hours
Choose *one* of the following four courses:	
TECH 619 Construction Systems	3 hours
TECH 620 Manufacturing Systems	3 hours
TECH 621 Communication Systems	3 hours
TECH 622 Transportation Systems	3 hours
TECH 662 Technological Education Course Construction	3 hours
TECH 666 Technological Education Teaching Methods and Internship	4 hours
TECH 669 Safety in the Instructional Environment of Technological Education	3 hours
TECH 717/718 Special Problems I or II (starts portfolio development)	3 hours
subtotal	22 hours

Phase I Benchmarks for Technology Education, Teaching Concentration

*Pass Praxis II (Technology Education, Teaching Only).
Qualify for a clear Class A license.
Maintain a 3.0 GPA or better.
Pass the Products of Teaching Portfolio Assessment.
Submit GRE scores.

Phase II Courses (Technology Education)

CUIN 721 Advanced Methods and Internship	3 hours
CUIN 729 Diversity Issues in Public Schools	3 hours
TECH 762 Evaluation of Technological Education Programs	3 hours
TECH 764 Administration and Supervision of Technological Education	3 hours
TECH 767 Research and Literature in Technological Education (preparing a research proposal)	3 hours
TECH 768 Technological Seminar (conducting the research proposal)	3 hours
TECH 788 Comprehensive Final Exam	0 hours
subtotal	18 hours

Phase II Benchmarks

Pass the Products of Teaching Portfolio Assessment.
Maintain a GPA of 3.0 or better.

TOTAL 40 hours

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
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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 componets 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 666. Technological Education Teaching Methods and Internship **Credit 4 (3-2)**
Technology education teaching methodology will be studied. Students will learn unit planning, lesson planning, group and individual teaching techniques, media development and use, testing and evaluating outcomes of learning. Students will also learn student behavior control, addressing diversity through teaching methods, laboratory management, teaching ethics, working with families and teacher reflection on teaching and learning. Undergraduate students and MAT students who are currently teaching in the schools will participate in a 60 hour structured internship under the guidance of a master teacher. MAT licensure-only students not currently teaching in schools must participate in a 10-week, full-time internship, which fully engages the candidate in teaching and assessment of students.

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.

GCS-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.

MSTM-Master of Science in Technology Management (Graphic Communication Systems)

The School of Technology at North Carolina A&T State University offers a MSTM- Master of Science in Technology Management (Graphic Communication Systems) degree. This degree program is coordinated by the

Department of Manufacturing Systems and is designed to increase students' understanding of technology management challenges in an array of technical areas and to explore effective methods for dealing with accelerated technological changes.

ADMISSION REQUIREMENTS

The MSTM (Graphic Communication Systems) degree program, within the School of Technology, requires a 2.6 minimum GPA, three letters of recommendation, a well written Statement of Intent, and official transcripts.

PROGRAM OBJECTIVES

The MSTM (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 technology 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 technology management positions and have professional growth aspirations; (2) individuals recently completing their undergraduate study and wanting additional preparation prior to embarking on a career in technology; 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.

TECHNOLOGY MANAGEMENT (GRAPHIC COMMUNICATION SYSTEMS)

A total of 36 hours is required for the Master of Science in Technology Management for the thesis option and 33 hours is required for the non-thesis option. 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)

MSTM 600	Graduate Seminar (1 credit hour)
MSTM 701	Leadership and Technological Innovation (2 credit hours)
MSTM 702	Enterprise Resource Planning Systems
MSTM 703	Industrial Probability and Statistics
MSTM 704	Research Methods

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 Designed
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 771	Master Supervised Teaching I
GCS 772	Master Supervised Teaching II
GCS 731	Advanced graphic Techniques
GCS 788	Comprehensive Examination (0 credit hours)
TECH 717	Special Problems I
TECH 718	Special Problems II

Required Courses

Non-Thesis Option (6 hours)

MSTM 750	Internship I
MSTM 788	Comprehensive Final Exam
MSIT 789	Master's Project

Thesis Option (9 hours)

MSIT 780	Statistical and Research Methods in Industrial Technology II
MSIT 791	Thesis I
MSIT 792	Thesis II

MASTER OF SCIENCE IN INDUSTRIAL TECHNOLOGY
Concentration in Graphic Communication Systems
Coursework-Only Option

Student must have a minimum of three years of industry experience in the concentration of graphic communication systems. A total of 42 hours is required for a Master of Science in Industrial Technology with a concentration in Graphic Communication Systems. The total consists of 12 HOURS of Core Courses; 9 SH of Management Courses, 15 HOURS of Technical Electives, and 6 HOURS of Required Courses. Fifty percent of semester hours must be earned from 700 level courses.

Core Courses
(12 HOURS)

3 hrs	Problem Solving in Industrial Technology	MSIT 610
3 hrs	Concepts of Technological Innovations	MSIT 700
3 hrs	Leadership Development Seminar	MSIT 740
3 hrs	Statistical & Research Methods in Industrial Technology I	MSIT 779

Management Courses – Graphic Communication Systems
(9 HOURS)

3 hrs	Graphic Communications Organization and Management	GCS 733
3 hrs	Systematic Design of Training and Development for Industry	TECH 770

(Student is to select one course from the following.)

3 hrs	Industrial and Customer Relations in Graphic Comm.	GCS 637
3 hrs	CADD Management	GCS 638

Technical Electives – Graphic Communication Systems

(Student is to select 15 HOURS. Student may substitute up to 6 HOURS of Technical Elective courses from any School of Technology department with prior approval of advisor.)

3 hrs	Advanced Flexographic Methods	GCS 601
3 hrs	Multimedia and Videography	GCS 630
3 hrs	Advanced Computer Aided Design	GCS 631
3 hrs	Graphic Animation	GCS 632
3 hrs	Advanced Machine Design and Drafting	GCS 633
3 hrs	Advanced Multimedia and Videography	GCS 634
3 hrs	Advanced Principles in Graphic Communications Tech.	GCS 635
3 hrs	Electronic Imaging in Distance Learning	GCS 636
3 hrs	Digital Architecture	GCS 639
3 hrs	Architectural Technology and Sustainable Design	GCS 640
3 hrs	Architectural Animation and Rendering	GCS 641
3 hrs	Advanced Architectural Drafting and Design	GCS 644
3 hrs	Electronic Imaging in Graphic Communications	GCS 670

Required Courses:
(6 HOURS)

0 hrs	Master's Comprehensive Exam	GCS 788
3 hrs	Special Problems I	TECH 717
3 hrs	Special Problems II	TECH 718

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.

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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.

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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.

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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.

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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.

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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 771. Master Supervised Teaching I **Credit 3(3-0)**
Students will gain teaching experience under the mentorship of faculty who assist the students in planning for the teaching assignment, observe and provide feedback to the students during the teaching assignment and evaluate the students upon completion of the assignment.

GCS 772. Master Supervised Teaching II **Credit 3(3-0)**
Students will gain teaching experience under the mentorship of faculty who assist the students in planning for the teaching assignment, observe and provide feedback to the students during the teaching assignment and evaluate the students upon completion of the assignment.

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.

Directory of Faculty

Elinor Blackwell ……………………………………………………**Assistant Professor**
B. S. and M.S., NC A&T State University, Ed.D., North Carolina State University
Vincent W. Childress ……………………………………………………**Professor**
B.S., M.S., Ph.D., Virginia Polytechnic Institute and State University
Robert Cobb, Jr……………………………………………………**Associate Professor**
B.S., Virginia Polytechnic Institute and State University; M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University
Ray Davis ……………………………………………………**Professor**
B.S., University of Maryland Eastern Shore; M.S., Ph.D., Ohio State University
Sonja Draper ……………………………………………………**Assistant Professor**
B.S., East Carolina, M.S. North Carolina A&T State University, Ph.D,. Virginia Polytechnical and State University
Brenda S. Faison ……………………………………… **Associate Professor and Chairperson**
B.A., North Carolina Central University**;** M.P.D., North Carolina State University**;** Ph.D., The Ohio State University
Cynthia C. Gillispie-Thompson……………………………………………………**Professor**
B.S., North Carolina A&T State University; M.S., University of North Carolina at Greensboro; Ph.D., Virginia Polytechnic Institute and State University
Tony Graham ……………………………………………………**Associate Professor**
B.S. NC A&T State University, M.S. and Ph.D., Morgan State University
Mitchell Eugene Henke ……………………………………………………**Assistant Professor**
B.S., Ohio State University, M.S., Bowling Green State University, Ph.D. Virginia Polytechnic and State University
Arjun Kapur ……………………………………………………**Assistant Professor**
B.S., M.S., Punjab University; M.E., McGill University; Ph.D., Indian Institute of Technology,
Devang P. Mehta …………………………………………………… **Associate Professor**
B.S., University of Bombay; M.A., DIT, University of Northern Iowa
Craig Rhodes ……………………………………………………**Associate Professor**
B.S., M.S., North Carolina A&T State University; Ph.D., University of Wisconsin-Stout,

Human Performance and Leisure Studies

R. Trent Larson, Chairperson
Suite 215 Corbett Gymnasium
(336) 334-7719
http://www.ncat.edu/~schofed/

OBJECTIVES

The Department of Human Performance and Leisure Studies (HPLS) offers an advanced graduate program of study leading to a Master of Science in Physical Education and a Master of Arts in Teaching Physical Education degrees. 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 standards-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.

DEGREES OFFERED

Master of Science in Physical Education
Master of Arts in Teaching Physical Education

GENERAL PROGRAM REQUIREMENTS – MASTER OF SCIENCE (M.S.) IN PHYSICAL EDUCATION

The admission of students to graduate degree programs 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
- An overall undergraduate GPA of 2.60 for the non-teaching option and 2.8 for the teaching option
- Official scores on GRE (Graduate Record Examination) or the MAT (Miller Analogies Test) taken during the last five (5) years, and
- A goal statement
- An initial teaching "A"certificate for the teaching option
- A formal interview to be conducted by the graduate faculty
- An abbreviated curriculum vitae

DEPARTMENTAL REQUIREMENTS – MASTER OF SCIENCE (M.S.) IN PHYSICAL EDUCATION

Teaching Option - The Master of Science degree program in the HPLS department provides an advanced level of study in two options: teaching and non-teaching. The teaching option has three areas of concentration: (a) teacher education, (b) adapted physical education, and (c) sport psychology. Similarly, the non-teaching option has the same concentrations EXCEPT teacher education.

The student may elect to take thirty-six (36) hours of course work and write a thesis for three (3) credit hours 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- hour research seminar course (HPED 798) to complete the required thirty-nine (39) total credit hours. In addition, the student must pass the comprehensive examination.

Non-Teaching Option - 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.*** The student must also pass the comprehensive examination.

GENERAL PROGRAM REQUIREMENTS – MASTER OF ARTS IN TEACING (M.A.T.) PHYSICAL EDUCATION

Students applying to the Master of Arts in Teaching (M.A.T.) Physical Education program must satisfy the following admission requirements:

- **An undergraduate degree earned from an accredited four-year institution of higher education**
- **Pass Praxis 1 or an overall undergraduate GPA of 2.5**

DEPARTMENTAL REQUIREMENTS – MASTER OF ARTS IN TEACHING (M.A.T.) PHYSICAL EDUCATION

The M.A.T. degree program requires the completion of 39 graduate credit hours which are divided into two phases: Phase I (Certification Only Phase), and Phase II (M.A.T. Phase).

Phase I: (Certification Only Phase: 24 credit hours))

Students in Phase I must satisfy the pre-requisites in Kinesiology and Anatomy/Physiology. Students in this phase must complete 24 credit hours of graduate course work with a 3.0 cumulative Grade Point Average (GPA). In addition, they must apply for admission to the Teacher Education Program, pass Praxis II, complete the Physical Education Teacher Education (PETE) internship requirement, and obtain an initial teaching "A" certificate.

Phase II: (Master of Arts in Teaching Phase: 15 credit hours)

Students in Phase II must have completed Phase I with a cumulative overall GPA of 3.0, and obtained acceptable scores in Graduate Record Examination (GRE) or Miller Analogy Test (MAT). In this phase, students must pass the required 15 credit hours of advanced graduate course work with a 3.0 overall GPA. In addition, they must complete the capstone experience in the form of a research seminar project, and pass a comprehensive examination.

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CAREER OPPORTUNITIES

A graduate degree in the field of Physical Education provides content for students preparing for careers in the publicschools, post-secondary teaching and research, public service and further academic advancement.

GRADUATE COURSE OFFERRINGS

HPED 610	Health, Safety, and Liability in Physical Education	3
HPED 611	Understanding Human Motor Development	3
HPED 612	Movement Forms and Motor Learning	3
HPED 613	Philosophical Foundation of Pedagogy in PE	3
HPED 615	PETE Internship **(Period of 10 consecutive weeks)**	**3**
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 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 610 . Health, Safety, and Liability in Physical Education **Credit 3(3-0)**
This course is designed to study research-based practices regarding health and safety issues, health-related fitness appraisals, and legal/liability principles pertaining to physical education activities. Emphasis is also focused on the effects of substance abuse on human performance and behavior. In addition, strategies in adapting health-related fitness appraisal activities for individuals with special needs will be examined.

HPED 611. Understanding Human Motor Development **Credit 3(3-0)**
This course is designed to develop the knowledge and skills necessary in understanding human motor development. Course content includes fundamental movements, movement concepts, growth and motor development, and the role of perception in movement. In addition, development and implementation of developmental movement programs, including assessment of motor ability will be equally emphasized with considerations fir individuals with special needs.

HPED 612. Movement Forms and Motor Learning **Credit 3(3-0)**
This course is designed to address theoretical and practical issues pertaining to the understanding of humans' development various dance and rhythmic skills, as well as analyses of individual, dual, and team sport skills. Moreover, emphasis is placed on humans' learning of motor skills with respect to assessment and programming developmentally appropriate activities.

HPED 613. Philosophical Foundations of Pedagogy in Physical Education **Credit 3(3-0)**
This course is designed to address theoretical and practical application based pedagogical issues which impact physical education as it relates to its history, contemporary philosophical views, sociological factors, and psychological factors. Moreover, this course will address the issue of teacher accountability in the public schools and the impact of teachers' philosophical views on the physical education curriculum.

HPED 615. PETE Internship (Period of 10 consecutive weeks) **Credit 3(3-0)**
This course is designed to facilitate students' teaching and implementation of empirical-based pedagogical best practices; respond to learners' exceptionalities/diversities; appropriate use of North Carolina course of study; use of technology to create supportive learning environments; participation in other school-based activities (e.g., Guidance activities, child accounting, cocurricular activities, parent-teacher associations, teachers' meetings), which will aid in developing a Master teacher. In addition, student teachers must complete one semester of actual supervised teaching, which meets North Carolina Department of Public Instruction (NCDPI) required contact hours of teaching learning in the public schools.

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.

Graduate Faculty

Department: Human Performance and Leisure Studies
Chair: Dr. R. Trent Larson

Deborah J. Callaway, B.S., Virginia State College; M.Ed., Virginia Commonwealth University; Ed.D., Virginia Polytechnic Institute and State University; Associate Professor

Teresa Dail, B.S., Wake Forest University; M.S., University of North Carolina at Chapel Hill, Ph.D., University of North Carolina at Greensboro, Assistant Professor

Gloria M. Palma, B.S., University of the Philippines; M.S., Ph.D., Washington State University; Associate Professor

Daniel Webb, B.S., Coppin State College; M.S., University of Wisconsin; Ph.D., Ohio State University, Assistant Professor

HISTORY

Olen Cole, Jr., Chairperson
324 Gibbs Hall
(336) 285-2324
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
Master of Arts in Teaching - History Education (Phase II of the M.A.T. program is currently under revision. For more information, students should contact the Department of History).

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.

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. CUIN 619 Learning Theories (3)
2. CUIN 721 Advanced Methods (3)
3. CUIN 729 Diversity Issues in K-12 Public Schools (3)
4. CUIN 711 Methods and Techniques of Research (3)
5. CUIN 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 619	Modern China
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 699	Methods and Internship in History
HIST 701	Recent United States Diplomatic History
HIST 703	The Pacific War
HIST 712	Twentieth Century African-American History
HIST 713	Problems in African History
HIST 714	Colloqium in World 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 619. Modern China
The course will begin with attention to the main characteristics of traditional Chinese civilization. The focus of the course will be on the political, social, economic, and intellectual changes in Chinese society from the 1840s to the present

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 Unites 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 699. Methods and Internship in History **Credit 3 (2-8)**
This required course for students in the MAT program focuses on a field experience that emphasizes the development and use of teaching strategies, methods, skills, and assessments as they relate to the principles of teaching and learning in the area of history education. Candidates will learn to apply, plan and manage skills related to instruction, discipline, behavioral concerns and decision-making in small group and whole class instruction. Course content will include a variety of teaching strategies, methods, skills, and instructional resourses. (F,S)

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 713. Problems in African History **Credit 3(3-0)**
This course will introduce students to controversies and clashing views in African History.

HIST 714. Colloquim in World History **Credit 3(3-0)**
This course requires students to engage in intensive reading, discussion, and written analysis of selected topics in world history. It is designed to enable prospective teachers to strengthen their delivery of world history surveys and elective at the level of secondary education.

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.

Graduate Faculty

Department: **History**
Chair: **Dr. Olen Cole, Jr.**

Olen Cole, Jr., B.A., M.A., California State University at Fresno; Ph.D., University of North Carolina at Chapel Hill; Professor and Chair
Fuabeh P. Fonge, B.A., The University of Yaounde; M.A., Georgetown University; Ph.D., Howard University; Associate Professor
Karen Hornsby, B.A., California State University-Sacramento; M.A., Ph.D., Bowling Green State University; Associate Professor
Conchita F. Ndege, B.F.A., Xavier University; M.A., Ph.D., Howard University; ProfessorThomas E. Porter, B.A., Loyola College; M.A., Ph.D., University of Washington; Professor
Michael Roberto, B.A., Adelphi University; M.A., University of Rhode Island; Ph.D., Boston College; Assistant Professor James A. Wood, B.A., Tufts University; M.A., Ph.D., University of North Carolina at Chapel Hill; Associate Professor and Graduate Coordinator
Yunqui Zhang, B.A., Qufu Normal University; M.A., Ph.D., University of Toronto; Associate Professor

Human Development and Services

Dr. Miriam Wagner, Chairperson
Room 329 New Education Building
(336) 334-7916

OBJECTIVES

The objective of the Department of Human Development and Services is 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.

CAREER OPPORTUNITIES

Departmental graduates pursue professional careers within 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 within schools 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. Community Counseling students work in behavioral health, university and college counseling centers, victim advocacy, family counseling settings, and substance abuse counseling programs.

Classes are 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 School Counseling
Master of Science Degree in Community Counseling
Master of Science Degree in Human Resources (Rehabilitation Counseling)
Master of Science Degree in School Administration

CERTIFICATES OFFERED

Marriage and Family Counseling
Rehabilitation Counseling & Behavioral Addictions (RCBA)
Vocational Evaluation and Work Adjustment (VEWA)
School Administration Certificate

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 and School Administration applications are March 1st for fall admissions and October 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 students must complete and forward the application including submission of three letters of recommendation to the Graduate School. Applicant packets will be reviewed by the Graduate School and forwarded to the Department of Human Development and Services. Applicants may be requested to participate in a pre-admissions interview with departmental faculty. The GRE is not required for admission to Adult Education and Counseling unless recommended by the Departmental Admissions Committee. School Administration applicants are required to present GRE or MAT (Miller Analogies Test) scores that are not more than five (5) years old.

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. All application documents should be submitted to:

North Carolina A&T State University
School of Graduate Studies
ATTN: Admissions
120 Gibbs Hall
Greensboro, NC 27411

ADULT EDUCATION DEGREE 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 DEGREE REQUIREMENTS

School Counseling and Community Counseling majors must complete 60 hours of graduate work. The school and community programs of study are composed of a professional core curriculum consisting of 45 graduate semester hours, including a faculty supervised practicum experience and two 300 hour internships, in addition to a minimum of 15 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 three tracks as options in the counseling curriculum. The **Community Counseling** track prepares students for a variety of counseling careers in public and private community agency and 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. Rehabilitation Counseling majors complete 48 hours of graduate work.

All major courses in counseling must be taken at North Carolina A&T State University. All "provisionally admitted" students must be reviewed after 9 hours of course work. No additional courses can be taken until an "unconditional" application has been submitted, reviewed, and accepted by the faculty. The academic progress of each counseling student is bench marked each semester of matriculation.

Master of Science Degree - Community Counseling

The Community Counseling program is a 60 credit hour generalist program leading to numerous career options in areas such as marriage and family counseling, substance abuse counseling, mental health counseling, behavioral health, college counseling and others. Students in the Community Counseling master's program take core counseling courses and electives relative to the area of professional interest. Students also complete a 100 hour practicum and 600 hours of internship in a setting relative to the specific career objective. The Community counseling program is a flexible and high quality evening program which offers students the opportunity to create an individualized rate of matriculation in either part-time or full-time enrollment.

The Community Counseling program is nationally accredited by the Council on the Accreditation of Counseling and Related Educational Programs (CACREP) meaning that curricular experiences encompass each of the eight core areas of professional counseling which include Professional Identity, Social and Cultural Diversity, Human Growth and Development, Career Development, Helping Relationships, Group Work, Assessment, and Research and Program Evaluation. Additionally, students are prepared to take the National Counseling Examination (NCE) offered by the National Board for Certified Counselors (NBCC) which is administered twice annually at NCA&T. Students are also eligible to apply for licensure as a Licensed Professional Counselor through the North Carolina Board of Licensed Professional Counselors upon completion of the program. Students who pass the NCE prior to graduation are recognized as board eligible by NBCC.

Community Counseling Program Objectives

- To create an understanding of the foundations of community counseling including trends; roles, functions, and standards of practice and credentialing of community counselors; policies and laws, ethical and legal considerations (e.g. the ACA Code of Ethics); and diversity issues.

- To establish the contextual dimensions of community counseling relative to roles in various practice settings and relative other professionals in those settings; organizational dimensions of community organizations; needs assessment; and community intervention, consultation, education and outreach.

- To develop the knowledge and skills necessary for community counselors relative to assessment, case conceptualization, theories of human development, psychopathology, diagnosis using the *Diagnostic and Statistical Manual*, and counseling plans; models, methods, and principles of program development and service delivery for a clientele; the empowerment of consumers to understand and access community resources; advocacy; and initialing, maintaining, and terminating counseling.

- To provide clinical instruction including the Practicum (100 clock hours) and the 600 clock hour internship in a community setting under the supervision of a qualified site supervisor during which the intern will complete a minimum of 240 direct service clock hours.

Master of Science Degree - Rehabilitation Counseling

The Human Resources (Rehabilitation Counseling) program is designed to prepare culturally competent counselors who specialize in working with persons with physical, developmental, cognitive, psychological, and neurological disabilities and/or illness. The 48 hour counseling program is accredited by the Council on Rehabilitation Education and has the following objectives:

- To equip students with knowledge, skills, and experiences to empower persons with disabilities through the counseling process

- To increase the student's knowledge of the role and functions of rehabilitation counselors
- To equip students with unique skills to provide effective rehabilitation counseling services within a cultural context
- To enhance the student's knowledge of the needs and associated resources to meet the evolving needs of persons with disabilities
- To prepare students to obtain professional licensure and certification if the profession of rehabilitation counseling
- To prepare student's to address professional issues in Rehabilitation Counseling through professional associations, publications, and professional development
- To prepare students to work in a variety of public and private settings in the rehabilitation counseling profession

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. The Rehabilitation Counseling program offers a 12 hour concentration in Rehabilitation Administration for students desiring additional preparation for leadership roles within rehabilitation settings. The program also offers a 12 hour Certificate Program in Rehabilitation Counseling and Behavioral Addictions for those currently enrolled in the 48 hour program.

Master of Science Degree – School Counseling

The Master of Science degree in Counselor Education (School Counseling) is a 60 credit hour program designed for individuals seeking a professional career in Elementary or Secondary School Counseling. Students in the Counselor Education master's program take core counseling courses and electives relative to their area of professional interest. Students also complete a 100 hour practicum and 600 hours of internship in a school counseling setting. The Counselor Education program is a flexible and high quality evening program which offers students the opportunity to create an individualized rate of matriculation in either part-time or full-time enrollment.

The Counselor Education program is nationally accredited by the Council on the Accreditation of Counseling and Related Educational Programs (CACREP) and curricular experiences and demonstrated knowledge encompasses each of the eight core areas of professional counseling which include Professional Identity, Social and Cultural Diversity, Human Growth and Development, Career Development, Helping Relationships, Group Work, Assessment, and Research and Program Evaluation. Additionally, students are prepared to take the PRAXIS II Specialty test in School Guidance and Counseling and the National Counseling Examination (NCE) of the National Board for Certified Counselors (NBCC) which is administered twice annually at NCA&T and apply for licensure as a licensed professional counselor through the North Carolina Board of Licensed Professional Counselors upon completion of the program. Students who pass the NCE prior to graduation are recognized as board eligible by NBCC. Practicum and internship hours are recognized by the North Carolina Licensed Professional Counseling board as hours of supervised practice.

The program objectives for school counseling are to:

1. Provide a graduate program in counselor education designed for the preparation of counselors and other personnel service specialists.
2. Provide within the framework of the total program, opportunities for the student to develop understandings and skills to function effectively as an entry-level counselor.
3. Encourage the spirit of inquiry and the production and utilization of research data among both faculty and students.
4. Provide opportunities for planned periodic self-evaluation and the development of greater self-understanding as well as the qualities of openness, tolerance, and acceptance for self and others.
5. Make information concerning major aspects of the counselor education program and faculty available in a variety of media for prospective students.
6. Make a continuing evaluation through systematic review of students as they progress through the program to ensure the professional qualification of each student.

Students in school counseling will demonstrate knowledge, understanding, and application in:

1. classroom guidance and instruction
2. developing and coordinating student support activities, including assessment and the use of diagnostic information
3. managing counseling programs to meet the academic, personal, and social needs of students
4. developing consultation skills suitable for working with all members of
5. the school and community environments – students, parents/families, teachers, administrators, as well as community agencies
6. establishing and maintaining individual and group counseling relationships
7. consistent with the ethical standards of the American Counseling Association, (ACA)
8. preparing individuals for positions as school counselors

SCHOOL ADMINISTRATION DEGREE REQUIREMENTS

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 (NCDPI) 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.
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.

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 internship.

Admission Requirements for Masters of School Administration are as follows:

1. Submit a formal application to the School of Graduate Studies, North Carolina Agricultural and Technical State University
2. 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.
3. Have an undergraduate grade point average of 2.8 on a 4.0 scale.
4. Present GRE or MAT (Miller Analogies Test) scores that are not more than five (5) years old.
5. Have a minimum of four (4) years of successful teaching experience and hold a Performance-based North Carolina Teaching Certificate.
6. Provide three letters of academic recommendations.
7. 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.
9. 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:

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

Community Education		**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
Higher Education		
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
Human Resource Development		
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
Instructional Technology		
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. Prerequisites ADED 707 and ADED 708.

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 concepts, Methods of teaching learned in earlier courses. Students will be encouraged to further explore areas of special interest.

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. Adult Education students only.

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. Prerequisite 707.

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. Prerequisites 707 and 708.

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 630	Statistical and Research Methodology	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 701	Counseling Exceptional Children	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 763	Family Counseling	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	OR	
HDSV 799	Internship I, and II	6
	Electives*	6
		60 Hours

Footnote::
Recommended Electives:

CUIN 701	**Philosophy of Education**	**3**
CUIN 720	**Curriculum Development**	**3**
SPED 661	**Psychology of Exceptional Individuals**	**3**
	Or any 600 level or above Special Education course	

Program of Study for the M.S. in Community Counseling

Course	Title	Credit Hours
HDSV 602	Human Development	3
HDSV 611	Community Agency Counseling	3
HDSV 630	Statistics and Research Methodology	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV		
HDSV 735	Counseling Methods (Lab)	3
HDSV 736	Multicultural Counseling	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 758	Clinical Assessment: The Diagnostic and Statistical Manual	3
HDSV 759	Substance Abuse Counseling	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
	OR	
HDSV 799	Internship I & II	6
	Electives	15
		60 Hours

Certificate in Marriage and Family Counseling

HDSV 753	Counseling Children and Adolescents	3
HDSV 754	Advanced Theory in Family Counseling	3
HDSV 756	Counseling Couples	3
HDSV 757	Special Topics in Marriage and Family Counseling	3
HDSV 774	Counseling Poor and Ethnically Diverse Families	3

Program of Study for the M.S. in Human Resources (Rehabilitation Counseling)

Course	Title	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 762	Advanced Assessment in Rehabilitaion	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
	OR	
HDSV 799	Internship I & II	6
		48 HOURS

Certificate in Vocational Evaluation and Work Adjustment

HDSV 771	Foundations of Vocational Evaluation	3
HDSV 772	Vocational Evaluation Laboratory	3

HDSV 776	Principles of Work Adjustment	3
Elective**		**3**

**Note: Students will select one of the following electives:

HDSV 752	American Sign Language	
HDSV 762	Advanced Assessment in Rehabilitation	3
HDSV 777	Assistive Technology in Vocational Evaluation and Work	3

Rehabilitation Administration Concentration

TECH 671	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

Rehabilitation Counseling and Behavioral Addictions Certificate

HDSV 665	Foundation and Theories of Addiction	3
HDSV 767	Psychopathology and Addictions	3
HDSV 768	Psychopharmacology and Addictive Behavior	3
HDSV 769	Marriage and Family Counseling in Addictions	3

Course Offerings in Counseling		**Credit**
HDSV 602	Human Development	3 (3-0)
HDSV 610	Counseling Services	3 (3-0)
HDSV 611	Community Agency Counseling	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 665	Foundation and Theories of Addiction	3
HDSV 701	Counseling Exceptional Children	3 (3-0)
HDSV 706	Organization and Administration of School Counseling Programs	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 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 Counseling	3 (3-0)
HDSV 752	American Sign Language	3 (3-0)
HDSV 753	Counseling Children and Adolescents	3 (3-0)
HDSV 754	Advanced Theory in Family Counseling	3 (3-0)
HDSV 756	Counseling Couples	3 (3-0)
HDSV 757	Special Topics in Marriage and Family Counseling	3 (3-0)
HDSV 758	Clinical Assessment: The Diagnostic and Statistical Manual	3 (3-0)
HDSV 759	Substance Abuse Counseling	3 (3-0)
HDSV 760	Career Counseling (Lab)	3 (3-0)
HDSV 762	Advanced Assessment in Rehabilitation	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 767	Psychopathology and Addictions	3
HDSV 768	Psychopharmacology and Addictive Behavior	3
HDSV 769	Marriage and Family Counseling in Addictions	3
HDSV 770	Applied Research in Counseling	3 (2-2)

HDSV 771	Foundations of Vocational Evaluation	3 (3-0)
HDSV 772	Vocational Evaluation Laboratory	3 (3-0)
HDSV 774	Counseling Poor and Ethnically Diverse Families	3 (3-0)
HDSV 775	Job Development and Placement	3 (3-0)
HDSV 776	Principles of Work Adjustment	3 (3-0)
HDSV 777	Assistive Technology in Vocational Evaluation and Work Adjustment Services	3 (3-0)
HDSV 780	Internship I	3 (0-6)
HDSV 788	Comprehensive Examination	0
HDSV 790	Internship II	3 (0-6)
HDSV 799	Internship I and II	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-611. Community Agency Counseling **Credit 3 (3-0)**
Counseling delivery systems and procedures found in community/agency settings will be examined 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 630. Statistics and Research Methodology **Credit 3 (3-0)**
Basic statistical methods and the tools of research make up the content of this course.

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 and HDSV 610 or HDSV 602 and HDSV 612

HDSV-665. Foundation and Theories of Addiction **Credit 3 (3-0)**
This course will introduce students to a wide range of theories and models of addiction, culturally competent treatment practices, and other topics related to addictions including, but not limited to, alcohol and other drug abuse, gambling addiction, sex addiction, eating disorders, and criminal offense.

HDSV-701, Counseling Exceptional Children **Credit 3 (3-0)**
This course will examine the assessment and placement needs of exceptional children in the school setting and_ explore strategies for counseling and guidance. Prerequisite: HDSV 650.

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 610and 640

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. Psychological 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-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 or HDSV 640

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.

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 650

HDSV-752. American Sign Language **Credit 3 (3-0)**
This course is a basic course in manual communication with persons who are deaf.

HDSV-753. Counseling Children and Adolescents **Credit 3 (3-0)**
This course will introduce students to theories and techniques related to counseling children and adolescents with an emphasis on social, familial, and cultural contexts. Prerequisite: HDSV 735.

HDSV-754. Advanced Theory in Family Counseling **Credit 3 (3-0_**
This course will focus on selected emerging family systems theories and the respective techniques and assessments. Prerequisites: HDSV 763 or HDSV 738.

HDSV-756. Counseling Couples **Credit 3 (3-0)**
This course will examine the relationship dynamics of couples, their role in the family system and strategies for effective counseling. Prerequisites: HDSV 763 or HDSV 738.

HDSV-757. Special Topics in Marriage and Family Counseling **Credit 3 (3-0)**
This course will provide an in depth perspective on selected topics in contemporary marriage and family counseling. Prerequisites: HDSV 763 or HDSV 738._ _

HDSV-758. Clinical Assessment: The Diagnostic and Statistical Manual (DSM) Credit 3 (3-0)
This course will introduce students to the Diagnostic and Statistical Manual as a tool for clinical assessment of mental disorders. Prerequisite: HDSV 740.

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-762. Advanced Assessment in Rehabilitation Credit 3 (3-0)
This course will examine the principles, processes, and techniques used to diagnose vocationally related assets and disabilities of the individual with disabilities. Prerequisite: HDSV 740.

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 and 750 or 743 and 750.

HDSV-767. Psychopathology and Addictions Credit 3 (3-0)
This course will familiarize students with criteria, co-morbidity rates, co-existing disorders, and issues of differential diagnosis based on the Diagnostic and Statistical Manual (DSM). Various behavioral addictions will be explored within a cultural framework. Prerequisites: HDSV 738

HDSV-768. Psychopharmacology and Addictive Behavior Credit 3 (3-0)
This course addresses the ways in which alcohol, and other addictive substances affect the brain and behavior. Addictions addressed include, but are not limited to, alcohol and other drug abuse, gambling addiction, sex addiction, eating disorders, and criminal offense. This course will also explore the different classes of drugs and the associated street names for each drug. Prerequisites: HDSV 743.

HDSV-769. Marriage and Family Counseling in Addictions Credit 3 (3-0)
This course will introduce the student to systems theory and the affects of the cycle of addictions on the family. The specific addictions addressed include, but are not limited to, alcohol and other drug abuse, gambling addiction, sex addiction, eating disorders, and criminal offense. Culturally relevant values and practices in providing services to the family will also be addressed. Prerequisites: HDSV 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-771. Foundations of Vocational Evaluation Credit 3 (3-0)
This course will explore the basic philosophies, practices, and processes of vocational evaluation when working with individuals with disabilities. Specific topics will include assessment tools and instruments,

refinement of clinical skills, analysis of information for career planning, and identification of relevant behaviors. Prerequisites: HDSV 740.

HDSV-772. Vocational Evaluation Laboratory **Credit 3 (3-0)**
This course is the application of the procedures and tools of vocational evaluation. This course includes interviews, individual evaluation plans, standardized tests, vocational counseling, work samples, situational assessments, and work-related behavioral observations. Prerequisite: HDSV 771.

HDSV-774. Counseling Poor and Ethnically Diverse Families **Credit 3 (3-0)**
This course will introduce students to sociocultural issues impacting families, the historical and political context of their dilemmas, and strategies for intervention in contemporary society. Emphasis will be placed on understanding ethnicity and socioeconomic status. Prerequisites: HDSV 763 or HDSV 738.

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-776. Principles of Work Adjustment **Credit 3 (3-0)**
This course will explore the principles and practices of work adjustment in rehabilitation. There is an emphasis on the change and improvement of behavior as well as practical experience in interviewing, behavior observation, individual work adjustment planning, and report writing. Prerequisite: HDSV 775.

HDSV-777. Assistive Technology in Vocational Evaluation and Work Adjustment Services **Credit 3 (3-0)**
This course is an introduction to an array of assistive technology services and products facilitating professional interventions and vocational evaluation procedures in application to the assessment of persons with disabilities.

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 e required. Prerequisites: HDSV 765 and all professional core courses as specified by track. *

HDSV 788. Comprehensive Examination **Credit 0 (0-0)**
All counseling students must register for this course to sit for the comprehensive examination in counseling.

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.*

HDSV-799. Internship I and II **Credit 6 (0-6)**
This course provides the option of taking Internship I and Internship II in the same semester Combining the traditional internship requirements into a one semester 600-hour experience. All other internship requirements remain consistent with HDSV 780 and HDSV 790.

Notes:
All major courses must be taken at North Carolina A&T State University.
All "provisionally admitted" students must be reviewed after 9 hours of course work. No additional courses can be taken until an "unconditional" application has been submitted, reviewed, and accepted by the 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)

Directory of Faculty

James J. Battle -B.S., M.S., M.S., Ed.S, Ed.D, North Carolina A&T State University; University of North Carolina at Greensboro; Nova Southeastern University: MSA Program Assistant

Patricia D. BetheaWhitfield, B.A., North Carolina Central University; M.Ed., University of North Carolina at Chapel Hill; Ed.D, University of North Carolina at Greensboro; Associate Professor

Kacie Blalock , B.A., Grambling State University; M.S., Southern A&M University; PhD, University of Wisconsin; Assistant Professor

Carolina Booth; B.A., Wake Forest University; M.S., PhD, University of North Carolina at Greensboro, Assistant Professor

Bernadine Chapman, B.S., Elizabeth City State University; M.A., Teachers College, Columbia University; Ed.D., North Illinois University; Associate Professor

Edward Fort, B., B.S., M.Ed., Wayne State University; Ed.D., University of California, Berkeley; Professor and Chancellor Emeritus

Linda Hopson. B.S.; Livingstone College; M.S., North Carolina Central University; M.S., North Carolina A&T State University; Associate Professor

Robin G. Liles, B.A., University of North Carolina at Chapel Hill; M.S., Ed.S., Ph.D., University of North Carolina at Greensboro; Associate Professor

David L. Lundberg, B.S., United States Air Force Academy; M.Ed., Boston University; Ph.D., University of North Carolina at Greensboro; Associate Professor

Stephanie Lusk, B.A.; University of Arkansas, MRC, Arkansas State University; Ph.D, University of Arkansas; Assistant Professor

Barbara O'Neal, B.S.; Winston-Salem State University; M.S., North Carolina A&T State University; Ph.D, Virginia Tech; Assistant Professor

Shirlene, Smith-Augustine, B.S., M.S., Ph.D, Indiana State University; Assistant Professor

Miriam L. Wagner, B.S., University of North Carolina at Greensboro; M.Ed., North Carolina A&T State University; Ed.D., University of North Carolina at Greensboro; Associate Professor and Interim Chairperson

Sharon Waldrum, B.S., M.S., North Carolina A&T State University, Ph.D, University of South Florida.

Tammy T. Webb, B.S., Coppin State College; M.S.W., Ohio State University; Ph.D., Mississippi State University; Assistant Professor

Tyra Turner Whittaker, B.S., Xavier University of Louisiana; M.S., Xavier University of Louisiana; RhD., Southern Illinois University-Carbondale; Associate Professor

Human Resources Management

Dr. Pamela E. Carter, Chairperson
Room 227 Merrick Hall
336-256-2645

OBJECTIVE

The Department of Management 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 2.75 (on a 4.0 scale), and a satisfactory GMAT score. A GPAof 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 18 hours of core courses, and 18 hours of coursework in the HRM concentration, including one 3-hour HRM elective.

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
MIS 713 Business Applications Development	3 semester hours
MGMT 715 Quantitative Business Analysis	3 semester hours
MKTG 716 Strategic Marketing	3 semester hours
MGMT 718 Management & Organization Analysis	3 semester hours
ECON 608 Managerial Economics	3 semester hours

ELECTIVE ***One course selected from the following:***

MGMT 735 Contemporary Issues in Human Resources Management	3 semester hours
MGMT 736 Human Resources Management Strategy	3 semester hours
MGMT 699 Special Topics in Human Resources Management	3 semester hours

Courses in the HRM concentration will consist of the following:

MGMT 730 Human Resources Management	3 semester hours
MGMT 731 Staffing	3 semester hours
MGMT 732 Training and Development	3 semester hours
MGMT 733 Compensation and Benefits	3 semester hours

MGMT 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
MGMT 705 Methods in Business Analysis	3semester hours
MGMT 712 Foundations 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
MGMT 705 Methods in Business Analysis	3
MGMT 712 Foundations of Enterprise Management	3
MIS 713 Business Applications Development	3
MGMT 715 Quantitative Business Analysis	3
MKTG 716 Strategic Marketing	3
MGMT 718 Management & Organization Analysis	3
MGMT 730 Human Resources Management	3
MGMT 731 Staffing	3
MGMT 732 Training and Development	3
MGMT 733 Compensation and Benefits	3
MGMT 734 Employee Relations	3
MGMT 735 Contemporary Issues in Human Resources Management	3
MGMT 736 Human Resources Management Strategy	3
MGMT 699 Special Topic in Human Resources Management	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3

COURSES WITH DESCRIPTION IN BUSINESS ADMINISTRATION

MGMT **705. Methods in Business Analysis** **Credit 3 (3-0)**
This course focuses on building an understanding of mathematical analysis techniques necessary to solve complex business problems from a wide range of business areas, including inventory, customer service, sales, and quality management. Basic statistical concepts and statistical process improvement are covered. Students will use a variety of computer software packages including Microsoft Excel and SPSS.

MGMT **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.

MIS **713. Business Applications Development** **Credit 3 (3-0)**
This course focuses on the use of object-oriented programming to develop applications for business solutions. Topics include user-interface design, basic programming logic and techniques, database concepts, and database applications.

MGMT **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; business forecasting; linear and multiple regression models; linear and integer, programming; and computer simulation. Emphasis will be on the application of these techniques for managerial decision-making. Prerequisites: ACCT 708, MGMT 705, MGMT 712 and ECON 706.

MKTG 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. Prerequisites: ACCT 708, MGMT 705, MGMT 712 and ECON 706.

MGMT **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. Prerequisites: ACCT 708, MGMT 705, MGMT 712 and ECON 706.

MGMT **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, MGMT 705, MGMT 712 and ECON 706.

MGMT 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: MGMT 730.

MGMT 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: MGMT 730.

MGMT 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 employee benefit plans; determining wage levels and structures; legal issuesand considerations in compensation and benefit administration; and expatriate compensation.Prerequisite: MGMT 730.

MGMT **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, collective bargaining, and international labor relations. Also includes legal aspects of employee relations. Prerequisite: MGMT 730.

MGMT 699. **Special Topics in Human Resources Management** **Credit 3 (3-0)**
This course will address selected topics in Human Resources Management (HRM). Examples include onsite assessment of HRM issues, strategies and policies: current trends in funding employee medical and retirement benefits; collective bargaining strategies for global enterprises; industry comparisons of critical success factors for HRM; and advanced technololgies for employee training and development. This course may also include an international experience (study abroad) when offered in the summer. Prerequisite: MGMT 730, MGMT 522, or permission of the instructor.

MGMT 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, MGMT 705, MGMT 712 and ECON 706.

MGMT 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, MGMT 705, MGMT 712 and ECON 706.

MGMT 699. Special Topics in Human Resources Management **Credit 3 (3-0)**
This course will address selected topics in Human Resources Management (HRM). Examples include onsite assessment of HRM issues, strategies and policies; current trends in funding employee medical and retirement benefits; collective bargaining strategies for global enterprises; industry comparisons of critical success factors for HRM; and advanced technologies for employee training and development. This course may also include an international experience (study abroad) when offered in the summer. Prerequisites: MGMT 730, MGMT 522, or permission of the instructor.

Directory of Faculty

Obasi Akan, B.A. Howard University; M.S. Case Western Reserve University; Ph.D. Case Western Reserve University; Assistant Professor
Hayward P. Andres, B.S., Southern University; M.S., University of West Florida; Ph.D., Florida State University; Associate Professor
Chiekwe Anyansi-Archibong, B.S., M.B.A., Ph.D., University of Kansas; Professor
Pamela Carter, B.I.S., George Mason University; MBA, University of Maryland – College Park; Ph.D., Florida State University; Chairperson and Associate Professor
Marka Fleming, B.S. Wake Forest University; J.D. North Carolina Central University; Assistant Professor
Roger J. Gagnon, B.S., Boston University; M.B.A., Clark University; Ph.D., University of Cincinnati; Associate Professor and Director of the Master of Science in Management Program
Rhonda L. Hensley, B.S., M.B.A., James Madison University; Ph.D., Virginia Commonwealth University; Associate Professor
Susan M. Houghton, B.A. Yale University; M.B.A. University of North Carolina at Chapel Hill; Ph.D. University of North Carolina at Chapel Hill; Associate Professor
Alice M. Johnson, B.A., Winston-Salem State University; M.S., Winthrop University; Ph.D., University of Kentucky; Associate Professor
Wanda F. Lester, B.S. ,Florida A&M State University; Ph.D., Florida State University; Interim Associate Vice Chancellor and Assistant Professor
Mary R. Lind, B.S., Duke University; M.B.A., Ph.D., University of North Carolina at Chapel Hill; Professor
Maranda E. McBride, B.S., M.S., Ph.D., North Carolina A&T State University; Associate Professor
Thaddeus McEwen, B.S., College of Arts, Science and Technology, Jamaica; M.S., Ph.D., Southern Illinois University at Carbondale; Professor

Angela K. Miles, B.A., University of Virginia; M.B.A., University of Wisconsin-Madison; Ph.D., Florida State University; Associate Professor

Shona D. Morgan, B.S., Spelman College; M.S., Ph.D., North Carolina State University; Associate Professor

Patrick Rogers, BSBA, M.B.A., Western Carolina University; Ph.D., University of Tennessee at Knoxville; Associate Professor

Belinda Shipps, B.A. Michigan State Univedrsity; A.A.S., Richland College; M.S., Ph.D., University of Wisconsin - Milwaukee; Assistant Professor

Alice Stewart, B.B.A., M.B.A., University of Kentucky; Ph.D., University of North Carolina at Chapel Hill; Associate Professor

George S. Swan, B.A., The Ohio State University; J.D., University of Notre Dame; LL.M., S.J.D., University of Toronto Faculty of Law; Associate Professor

Silvanus Udoka, B.S., Weber State University; M.S., Ph.D., Oklahoma State University; Associate Professor

Joanne M. Utley, B.S., M.A., Wake Forest University; Ph.D., University of North Carolina at Chapel Hill; Professor

Isaiah O. Ugboro, B.S., Utah State University; M.B.A., Ph.D., University of North Texas; Professor

Hong Wang, B.S., Dalian University of Technology; M.A., Ph.D., The Ohio State University; Associate Professor

Industrial and Systems Engineering

Paul Stanfield, 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. Three areas of concentration (Human-Machine Systems Engineering (HMSE), Manufacturing and Service Enterprise Engineering (MSEE), and Operations Research and Systems Analysis (ORSA) are being offered.

DEGREES OFFERED

Master of Science - Industrial Engineering
Ph.D. - Industrial Engineering

GENERAL PROGRAM REQUIREMENTS

The programs areopen to students with a bachelor's (or master's) degree in a scientific discipline from an institution of recognized standing. Students desiring to enter a 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 full 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 deficiencies in general professional prerequisites. Applicants with their highest degree from non-English speaking countries must complete the Test of English as a Foreign Language (TOEFL) exam and obtain a score according to NC A&T State Graduate School standards.

Admission Requirements for Masters Degree Program (MSIE)
The application and supporting materials must be submitted to the School of Graduate Studies. The Department will process applications within 30 days of receipt from the School of Graduate Studies.

Admission Requirements for Doctor of Philosophy in Industrial Engineering (Ph.D. in IE)
The application and supporting materials must be submitted to the School of Graduate Studies. The Department will process applications within 30 days of receipt from the School of Graduate Studies.

To be considered for admission to the Ph.D. in Industrial Engineering an applicant must satisfy the following requirements:

1. At least one degree in engineering.
2. A Bachelor of Science degree in Engineering or Computer Science from an EAC-ABET accredited (or international institution of recognized standing) program with a cumulative grade point average of 3.5 or above on a 4 point scale.

OR

A Master of Science degree in a discipline related to Industrial Engineering, from a college or university recognized by a regional or general accrediting agency, with a cumulative grade point average of 3.3 or above on a 4 point scale.

3. Complete the Graduate Record Exam (GRE) Aptitude Exam.

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 81 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) and Manufacturing and Service Enterprise Engineering (MSEE).

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	Information Systems	3
INEN 628	Six Sigma Quality	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 653	Engineering Entrepreneurship	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	1-3
INEN 694	Special Projects	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 Optimization	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	Integer and Network 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 861	Nano/Micro- and Bio-Manufacturing	3
INEN 885	Advanced Special Topics in Industrial Engineering	1-3

M.S. level Pass/Fail Courses

INEN 791	Master’s Comprehensive Exam	1
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	1-6
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	1-9
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 (2-2)**
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: Consent of Instructor.

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: 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-628. Six Sigma Quality **Credit 3(2-2)**
This course covers the current Six Sigma body of knowledge for process engineering and improvement as well as Lean concepts and tools. Topics covered include problem identification and implementation of improved operations and processes. This course prepares students to take the Six Sigma Certification Exam. A project is required. Prerequisite: Consent of Instructor.

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-653. Engineering Entrepreneurship **Credit 3 (2-2)**
This course focuses on innovation and entrepreneurial skills development oriented toward an engineering enterprise. The course covers key entrepreneurial areas of intellectual property; evaluation of market viability of new product ideas; shaping product ideas into the right products or services for the right markets; developing strategies for product positioning, marketing and operations; acquiring the resources needed to start a new venture; and leadership roles for the founders of engineering ventures. A project is required. Prerequisite: Consent of Instructor.

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: 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: 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: Graduate Standing.
INEN-685. Selected Topics in Industrial Engineering Variable **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 Variable **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 cash flow 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 Optimization **Credit 3 (3-0)**
This course addresses formulation, solution techniques and applications of linear programming problems. Topics covered include simplex-method, revised simplex method, duality, sensitivity analysis, large scale linear programs, column generation, Dantzig-Wolfe decomposition, interior point methods, and computer solutions. Prerequisites: 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.

INEN791 Masters Comprehensive Exam **Credit 1(1-0)**
This course will guide the student to take the M.S. Comprehensive Exam. The examination will be administered towards the end of the semester. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Graduate Standing.

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 1-6**
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: 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. Integer and Network Optimization **Credit 3 (3-0)**
This course addresses formulation and solution techniques for integer programming problems and network optimization problems. Topics covered include integer programming models, branch and bound method, transportation, assignment, and transshipment problems, and network flow problems such as shortest-path, maximum-flow, activity networks, minimum-cost network flow, and minimum spanning tree. Prerequisite: Consent of Instructor.

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 861. Nano/Micro- and Bio-Manufacturing **Credit 3 (3-0)**
This course addresses the translation of fundamental nano-and biotechnology concepts to practical industrial applications. Topics include the design, prototyping and development of nano/micro- and bio-manufacturing techniques. Supporting infrastructure, measurement tools, characterization devices, and positioning systems needed for nano/micro- and bio-manufacturing are discussed. Current state-of-the-art research areas are discussed. Prerequisites: Graduate Standing and Consent of Instructor.

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)**
This course is for doctoral students who are preparing to take a written examination in their area of specialization. In this course dissertation supervisors will guide their students towards completing the Preliminary Exam. Pass/Fail evaluation only; no letter grade will be given. Prerequisites: Doctoral Standing in ISE and INEN 991.

INEN-997. Dissertation Variable **Credit 1-6**
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.

DIRECTORY OF FACULTY

Lauren Davis, Assistant professor, BS, Computational Mathematics, Rochester Institute of Technology; MSIME, Rensselaer Polytechnic Institute; Ph.D., North Carolina State University
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Silvanus J. Udoka, Associate Professor, BSIE, MSIE, Ph.D., Oklahoma State University

Leadership Studies Program

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(336) 256-2342

OBJECTIVES

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 Doctor of Philosophy degree in Leadership Studies 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. Continually expand a repertoire of global cross-cultural leadership competencies;
6. Understand theories of motivation and leadership as they influence ethical decision-making; and
7. 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 are currently in or aspiring toward positions of leadership from across industries and professions (e.g., agriculture, business, industry, science, engineering, education, the military and health, etc.), and who have a commitment to conducting research in the field of leadership. The program uses a scholar/practitioner approach in the development of leaders and scholars.

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 minimum cumulative grade point average (GPA) of 3.0 in the courses counted towards the Ph.D. degree.

A maximum equivalent of six credit hours may be transferred toward the degree requirements upon approval of the Chair and Dean. Courses eligible for transfer may not have previously been counted toward a degree. No transfer credit will be awarded for core courses.

Admission Requirements

Applicants 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, within the last five years.
4. Applicants with their highest degree from a non-English-speaking country are 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. Applicants 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 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

ADMISSION TO CANDIDACY

Admission to candidacy for the Ph.D. degree in Leadership Studies requires 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 completion of comprehensive exam.

Dissertation Committee

The committee will be composed of four members including the chair, and one member appointed by the Dean of Graduate Studies. At the end of a minimum eighteen hours of study, students are required to select their four-person dissertation committee. This committee will be chaired by a faculty member from North Carolina A&T State University. The additional committee members will consist of North Carolina A&T faculty including eminent leaders and adjunct faculty and/or an external member.

The Dissertation

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

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 during the Fall or Spring 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 requires 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. Emphasis is on the application of theories of leadership in political, economic, social, and global contexts. A critical examination of the literature on leadership is used to develop an appreciation for its contingency and interdisciplinary nature.

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 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. The course provides 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 on the role of leaders as ethical change agents at the behavioral, interpersonal, organizational, and societal levels. In-depth study of human behavior theories focuses 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 cultural diversity and the development of cultural understanding and competencies. Knowledge of the literature, history, language, art, music, and social/political systems of diverse cultures is emphasized.

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 information technology can enhance as well as constrain the functions of organizations. Topics 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 theories of effective organizational design. Emphasis is on the creation and use of vertical and horizontal networks of interdependent and interrelated relationships among functional and operating units, and how these networks 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 focuses on effective and ethical global leadership in the areas of decision-making and problem-solving, and the development of competencies for addressing relationships, communication, teambuilding, and leading visions into actions. 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 are emphasized

LEST 860 Qualitative Research **Credit (3-0)**
This course focuses on methods and tools of inquiry in 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 are 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 of literature reviews; data collection and statistical analysis; and the presentation of findings, conclusions, and recommendations. Students 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 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 focuses on research and case study design emphasizing implementation strategies that address organizational policies and practice. It includes a review of paradigm shifts, and an analysis of literature in the study of cultural and technological influences. The course enhances student understanding of how various public, private and corporate agencies are changed based on their governance and administration.

LEST 870. Internship in Leadership **Credit 3 (3-0)**
This professional practice internship provides inquiry, exploration, and hands-on opportunities to observe and participate in decisions in a leadership environment. Internships take place within a recognized business, industry, government or non-governmental setting, or in an organization that emphasizes leadership.

LEST 885. Special Topics **Credit 3 (3-0)**
This course allows the introduction of new topics on a trial basis at the doctoral level. The topic of this course will be determined prior to registration.

LEST 900. Dissertation Research **Credit 3 (3-0)**
This course focuses on the development of the dissertation proposal.

LEST 930. Dissertation Writing **Credit 3 (3-0)**
Dissertation writing is the culminating course in the doctoral program, and involves high levels of scholarly and intellectual activity. This course prepares students for conducting, writing, and defending dissertation research in accordance with the highest professional standards.

LEST 991. Doctoral Qualifying Examination **Credit 3 (3-0)**
This course will guide the student to take the qualifying examination. The qualifying examination will consist of a written examination over the Leadership Studies program core courses. Grading is pass/fail evaluation only.

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)

Directory of Core Faculty

Elizabeth Barber, Associate Professor of Leadership Studies; B.A., Roanoke College, English, Psychology and Education, M.S. / Ph.D., Virginia Tech, Literacy Studies

Daniel Miller, Associate Professor/Interim Chair, Leadership Studies; B.S., University of Nebraska, Psychology, M.S. / Ph.D., Cornell University, Organizational Behavior/Educational Leadership/Public Policy

Forrest Toms, Associate Professor of Leadership Studies B.S., M.A., Middle Tennessee State University; Ph.D., Howard University

Directory of Adjunct Faculty

William Gentry, Adjunct Associate Professor, B.S., Psychology, Emory University, M.S., University of Georgia, Psychology, Ph.D., University of Georgia, Psychology

Belinda McFeeters, Adjunct Associate Professor University of North Carolina at Greensboro, B.S., Business & Community Services, Minor: Sociology; 2nd Minor: Human Development and Family Studies, M.S., North Carolina A&T State University, Ph.D., Virginia Polytechnic Institute & State University,

Cynthia McCauley, Adjunct Associate Professor, B.A., King College, Psychology, M.A. / Ph.D., University of Georgia, Industrial Organizational Psychology;

Ellen Van Velsor, Adjunct Associate Professor, B.A., Southern New York University, Sociology, M.A., University of Florida, Sociology, Ph.D., University of Florida, Sociology,

Directory of Other Contributing Faculty

Vincent W. Childress, B.S., M.S., Ph.D., Virginia Polytechnic Institute and State University; Professor

Edward Fort, Chancellor Emeritus, Professor, B.S., Wayne State University; M.S., Wayne State University; Ed.D., Educational Administration/Leadership, University of California

Dorothy D. Leflore, Interim Dean, School of Education, B.S., Mississippi Valley State University; M.S., Ph.D., University of Oregon

Edna Ragins, Associate Professor/Chairperson, B.S., Business Administration/Management, Hampton University; M.S., Marketing, University of Wisconsin; Ph.D., Business Administration/Marketing and Communications, Florida State University

Judy Rashid, Professor, B.S., Psychology, North Carolina A&T State University; M.S., Educational Media, North Carolina A&T State University; Ed.D., Higher Education Administration, North Carolina State University

Alice Stewart, Associate Professor B.B.A., M.B.A., University of Kentucky; Ph.D., University of North Carolina at Chapel Hill;

Miriam Wagner, Associate Professor, Interim Chair Human Development and Services, B.A., English Literature, University of North Carolina at Chapel Hill; B.A., Psychology, University of North Carolina at Chapel Hill; M.S., School Counseling, North Carolina A&T State University; M.S., Human Development, North Carolina A&T State University; Ph.D., Community Counseling, University of North Carolina at Greensboro

Management Information Systems

Pamela E. Carter, Chairperson
Room 227 Merrick Hall
(336) 256-2645

OBJECTIVE

The Department of Management 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 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 2.75 (on a 4.0 scale), and a satisfactory GMAT score. A GPAof 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 18 hours of core courses and 18 hours of coursework, including one 3-hour MIS elective.

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
MIS 713 Business Applications Development	3 semester hours
MGMT 715 Quantitative Business Analysis	3 semester hours
MKTG 716 Strategic Marketing	3 semester hours
MGMT 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
MIS 719 Information Systems Planning & Design	3 semester hours

Courses in the MIS concentration will consist of the following:

MIS 740 Management and Implementation of Enterprise Information Systems	3 semester hours
MIS 742 Telecommunication Systems Management	3 semester hours
MIS 744 Enterprise Data Modeling	3 semester hours
MIS 746 E-Business and E-Commerce	3 semester hours
MIS 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
MGMT 705 Methods in Business Analysis	3 semester hours
MGMT 712 Foundations 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
MGMT705 Methods in Business Analysis	3
MGMT Foundation of Enterprise Management	3
MIS 713 Business Applications Development	3
MGMT 715 Quantitative Business Analysis	3
MKTG 716 Strategic Marketing	3
MGMT 718 Management & Organization Analysis	3
MIS 719 Information Systems Planning & Design	3
MIS 740 Management and Implementation of Enterprise Information Systems	3
MIS 742 Telecommunication Systems Management	3
MIS 744 Enterprise Data Modeling	3
MIS 746 E-Business and E-Commerce	3
MIS 748 MIS Projects	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3

COURSES WITH DESCRIPTION IN BUSINESS ADMINISTRATION

MGMT 705. Seminar in Business Analysis **Credit 3 (3-0)**
This course focuses on building an understanding of mathematical analysis techniques necessary to solve complex business problems from a wide range of business areas, including inventory, customer service, sales, and quality management. Basic statistical concepts and statistical process improvement are covered. Students will use a variety of computer software packages including Micorsoft Excel and SPSS.

MGMT 712. Foundation 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.

MIS 713. Business Applications Development **Credit 3 (3-0)**
This course focuses on use of object-oriented programming to develop applications for business solutions. Topics include user-interface design, basic programming logic and techniques, database concepts, and data base applications.

MGMT 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; business forecasting; linear and multiple regression models; linear and integer programming; and computer simulation. Emphasis will be on the application of these techniques for managerial decision-making. Prerequisite: ACCT 708, MGMT 705, MGMT 712 and ECON 706.

MKTG 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, MGMT 712 and ECON 706.

MGMT 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, MGMT 705, MGMT 712 and ECON 706.

MIS 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.
Project planning and design issues will be discussed in terms of the traditional systems developmental life cycle, business object models, object oriented analysis and design, and process analysis. Students will use a variety of contemporary tools such as Unified Modeling Language (UML), Computer Aided Software Engineering (CASE), Business Process Management (BPM) and Project Management in their project work. Prerequisite: MIS 713

MIS 740. Management and Implementation of Enterprise Information Systems **Credit 3 (3-0)**

This is an applied course in information systems concepts and techniques used in today's competitive business environment. Topics will include the concepts of enterprise information systems, the ways to use information systems to achieve business strategic goals and to gain competitive advantages, the impacts of information systems on business process reengineering and management, managerial issues in developing information systems, IS project management issues, and other contemporary IS technologies used in business. The implementation issues of organizational fit and innovation diffusion will be discussed along with security and ethics. Prerequisites: ACCT 708, MGMT 705, MGMT 712 and ECON 706.

MIS742. 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. Students will work on projects that cover network anlaysis, design, implementation and management issues, as well as applications of networks in business. Prerequisites: ACCT 708, **MGMT** 705, **MGMT** 712 and ECON 706.

MIS 744. Enterprise Data Modeling **Credit 3 (3-0)**

This course is designed to teach new forms of information and data modeling, take advantage of rich computer media, and offer a variety of conceptual approaches such as Object Role Modeling, Unified Modeling Language, and Entity Relationship Modeling. The role of data modeling in subsequent activities of an information technology project will be explored including business intelligence and competitive intelligence. Students will translate conceptual models into workable logical and physical designs resulting in a data base implementation.
Prerequisites:MIS 740 or MIS 742.

MIS 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 and implementing a business plan, accepting payments, marketing strategies, and security. A complete web-based e-business will be designed and developed based on a viable business plan. Prerequisites: MIS 740 or MIS 742.

MIS 748. MIS Projects **Credit 3 (3-0)**
This course Provides an in-depth practical application of the techniques used in the development of information technology-based solutions. Using current systems analysis and project management techniques, students will plan, design and implement a software project. Students may work in faculty-supervised teams with a sponsoring business. Typical project deliverables include: analysis and evaluation of existing business processes, evaluation of alternative solutions, system functional and data design, interface design, and a project implementation plan. Prerequisites: MIS 740, MIS 742 and MIS 744 or MIS 746.

Directory of Faculty

Obasi Akan, B.A. Howard University; M.S. Case Western Reserve University; Ph.D. Case Western Reserve University; Assistant Professor

Hayward P. Andres, B.S., Southern University; M.S., University of West Florida; Ph.D., Florida State University; Associate Professor

Chiekwe Anyansi-Archibong, B.S., M.B.A., Ph.D., University of Kansas; Professor

Pamela Carter, B.I.S., George Mason University; MBA, University of Maryland – College Park; Ph.D., Florida State University; Chairperson and Associate Professor

Marka Fleming, B.S. Wake Forest University; J.D. North Carolina Central University; Assistant Professor

Roger J. Gagnon, B.S., Boston University; M.B.A., Clark University; Ph.D., University of Cincinnati; Associate Professor and Director of the Master of Science in Management Program

Rhonda L. Hensley, B.S., M.B.A., James Madison University; Ph.D., Virginia Commonwealth University; Associate Professor

Susan M. Houghton, B.A. Yale University; M.B.A. University of North Carolina at Chapel Hill; Ph.D. University of North Carolina at Chapel Hill; Associate Professor

Alice M. Johnson, B.A., Winston-Salem State University; M.S., Winthrop University; Ph.D., University of Kentucky; Associate Professor

Wanda F. Lester, B.S. ,Florida A&M State University; Ph.D., Florida State University; Associate Dean and Assistant Professor

Mary R. Lind, B.S., Duke University; M.B.A., Ph.D., University of North Carolina at Chapel Hill; Professor

Maranda E. McBride, B.S., M.S., Ph.D., North Carolina A&T State University; Associate Professor

Thaddeus McEwen, B.S., College of Arts, Science and Technology, Jamaica; M.S., Ph.D., Southern Illinois University at Carbondale; Professor

Angela K. Miles, B.A., University of Virginia; M.B.A., University of Wisconsin-Madison; Ph.D., Florida State University; Associate Professor

Shona D. Morgan, B.S., Spelman College; M.S., Ph.D., North Carolina State University; Associate Professor

Patrick Rogers, BSBA, M.B.A., Western Carolina University; Ph.D., University of Tennessee at Knoxville; Associate Professor

Belinda Shipps, B.A. Michigan State Univedrsity; A.A.S., Richland College; M.S., Ph.D., University of Wisconsin - Milwaukee; Assistant Professor

Alice Stewart, B.B.A., M.B.A., University of Kentucky; Ph.D., University of North Carolina at Chapel Hill; Associate Professor

George S. Swan, B.A., The Ohio State University; J.D., University of Notre Dame; LL.M., S.J.D., University of Toronto Faculty of Law; Associate Professor

Silvanus Udoka, B.S., Weber State University; M.S., Ph.D., Oklahoma State University; Associate Professor

Joanne M. Utley, B.S., M.A., Wake Forest University; Ph.D., University of North Carolina at

Chapel Hill; Professor

Isaiah O. Ugboro, B.S., Utah State University; M.B.A., Ph.D., University of North Texas; Professor

Hong Wang, B.S., Dalian University of Technology; M.A., Ph.D., The Ohio State University; Associate Professor

Department of Marketing, Transportation and Supply Chain

Edna J. Ragins, Chairperson
Room 325 Merrick Hall
(336) 334-7656, ext 4011

OBJECTIVE

The Department of **Marketing, Transportation and Supply Chain** offers a program of study leading to the Master of Science in Management degree with a major concentration in Transportation and Supply Chain Management. The program prepares students and professionals for careers in public and private sector positions in transportation and supply chain management. 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 Supply Chain Management

GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.75 (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 minimum 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 18 hours of core courses and 18 hours of coursework, including one 3-hour elective, in the T/SCM concentration.

The student pursuing the Master of Science in Management with a major concentration in Transportation and Supply Chain Management is required to complete a common core of courses consisting of:

ACCT 714 Managerial Accounting & Finance	3 semester hours
MIS 713 Business Applications Development	3 semester hours
MGMT 715 Quantitative Business Analysis	3 semester hours
MKTG 716 Strategic Marketing	3 semester hours
MGMT 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
MIS 719 Information Systems Planning and Design	3 semester hours

Courses in the Transportation and Logistics concentration will consist of the following:

TSCM 701 Strategic Logistics Management	3 semester hours
TSCM 720 Analysis and Design of Supply Chain Systems	3 semester hours
TSCM 725 Purchasing and Materials Management	3 semester hours

TSCM727 Global Supply Chain Management	3 semester hours
TSCM 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
MGMT 705 Methods in Business Analysis	3 semester hours
MGMT 712 Foundations 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
MGMT 705 Methods in Business Analysis	3
MGMT 712 Foundations of Enterprise Management	3
MIS 713 Business Applications Development	3
MGMT 715 Quantitative Business Analysis	3
MKTG 716 Strategic Marketing	3
MGMT 718 Management & Organization Analysis	3
MIS 719 Information Systems Planning and Design	3
ECON 608 Managerial Economics	3
ECON 706 Seminar in Economics	3
TSCM 701 Strategic Logistics Management	3
TSCM 720 Analysis and Design of Supply Chain Management	3
TSCM 725 Purchasing and Materials Management	3
TSCM 727 Global Supply Chain Management	3
TSCM 730 Transportation Planning	3

COURSES WITH DESCRIPTION IN ECONOMICS AND TRANSPORTATION AND SUPPLY CHAIN MANAGEMENT

MIS 713. Business Applications Development **Credit 3 (3-0)**

This course focuses on the use of object-oriented programming to develop applications for business solutions. Topics include user-interface design, basic programming logic and techniques, database concepts, and database applications.

MIS 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 and information architectures. Project planning and design issues will be discussed in terms of the traditional systems developmental life cycle, business object models, object oriented analysis and design, and process analysis. Students will use a variety of contemporary tools such as Unified Modeling Language (UML), Computer Aided Software Engineering (CASE), Business Process Management (BPM) and Project Management in their project work. Prerequisite: BUAD 713

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, cost benefit 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.

TSCM-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.

TSCM-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.

TSCM-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.

TSCM-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.

TSCM-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.

Directory of Faculty

Abdussalam Addus…………………………………………………………………… **Associate Professor**
B.A., Addis Ababa University; M.S., University of Wisconsin; Ph.D., Pennsylvania State University;
Julian Benjamin……………………………………………………………………………………**Professor** B.S., New York University; M.S., Ph.D., State University of New York at Buffalo
Jeffrey G. Blodgett ……………………………………………………………………….. **Associate Professor**
B.S.; University of Illinois (Urbana-Champaign); M.B.A., Illinois State University; PhD., Indiana University

Kathryn Cort…………………………………………………………………………………Assistant Professor
B.S.Ed., M.A., The Ohio State University; M.B.A. and Ph.D., Kent State University
Kathryn E. Dobie……………………………………………**Professor & Director of Transportation Institute**
B.M., Wittenburg University; A.S., Dalton College; M.B.A., University of Central Arkansas; Ph.D., University of Memphis; C.P.M.
Lawrence M. Glisson…………………………………………………………………………………**Professor**
B.S., M.A., East Carolina University; M.B.A., Ph.D., The American University; C.P.M.
Keith C. Jones……………………………………………………………………………..**Associate Professor**

B.S., Northeast Missouri State University (Truman State University); M.B.A., Northwest Missouri State University; Ph.D., The University of Memphis
Roland Leak………………………………………………………………………………………Assistant Professor
B.S., North Carolina A&T State University; M.B.A., Wake Forest University; Ph.D., University of South Carolina
Kimberly R. McNeil…………………………………………………………………………..**Associate Professor**
B.S., North Carolina A&T State University; Ph.D., Florida State University
Japhet H. Nkonge…………………………………………………………………………………...**Professor**
B.A., North Carolina A&T State University; M.B.A., Rutgers University; Ph.D., University of North Carolina at Chapel Hill
Kofi Obeng……………………………………………………………………………………………….**Professor** B.Sc., University of Science & Technology (Kumasi, Ghana); A.M., Ph.D., University of Pennsylvania
Edna Johnson Ragins…………………………………………………...**Associate Professor and Chairperson**
B.S., Hampton University; M.S., University of Wisconsin; Ph.D., Florida State University
Harry Sink……………………………………………………………………………………… **Associate Professor** B.S., M.B.A., Ph.D., University of Tennessee
George W. Stone………………………………………………………………………………**Associate Professor**
B.S., United States Military Academy, West Point; M.B.A., Boston University; Ph.D., University of Mississippi
Jacqueline Williams…………………………………………………………………………..**Associate Professor**
B.S., Drexel University; M.B.A., University of Delaware; Ph.D., Florida State University

Mathematics

Guoqing Tang, Interim Chairperson
102 Marteena Hall
(336) 285-2033

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. The Mathematics Department also offers a program of studies leading to the Master of Arts in Teaching (MAT)-Mathematics. The MAT-Mathematics program is designed for the college graduate of the respective areas who seeks licensure and graduate studies in teaching k-12 mathematics. In addition, it offers a program of studies leading to the M.S. degree in Applied Mathematics.

DEGREES OFFERED

Master of Science - Mathematics Education
Master of Arts in Teaching – Mathematics
Master of Science - Applied Mathematics

GENERALADMISSION REQUIREMENTS

Mathematics Education, MAT-Mathematics 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.

MAT-Mathematics students must go through two-phase application process. Criteria for admission to Phase I of the MAT-Mathematics program are:

- A Bachelor's Degree from an accredited institution
- Completion of required prerequisite courses
- An undergraduate GPA of 2.5 or better, or passing scores on Praxis I

Admission criteria to Phase II of the MAT-Mathematics program are:

- A GPA of 3.0 or better in Phase I coursework
- Passing scores on Praxis II and Class A licensure
- Satisfactory recommendations from the candidate's principal, if teaching, or from three persons knowledgeable of his/her interactions with children or adolescents
- DPI letter of employment or letter from school system
- GRE or MAT scores
- Applicant's Essay of Purpose

DEPARTMENTAL REQUIREMENTS

In addition to meeting general requirements specified above, a student seeking admission to a graduate program either Applied Mathematics or Mathematics Education 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, twenty one (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 **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 Real Variable I
MATH 701	Theory of Functions of a Real Variable II
MATH 710	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

MAT-MATHEMATICS CURRICULUM

A student seeking the MAT-Mathematics must take the following prerequisite courses if his/her undergraduate degree curriculum does not include them:

MATH 110	Precalculus
MATH 131	Calculus I
MATH 132	Calculus II
MATH 224	Introduction to Probability and Statistics
MATH 450	Linear Algebra and Matrix Theory

Entrance requirements: Minimum 2.5 GPA

After meeting prerequisite requirements, the student must first complete Phase I coursework for initial licensure:

Phase I: Initial Licensure Courses (24 hours)

MATH 600	Introduction to Modern Mathematics
MATH 601	Technology and Applications in Secondary School Mathematics
MATH 602	Modern Algebra
MATH 604	Modern Geometry for Secondary School Teachers
CUIN 619	Learning Theories
CUIN 624	Reading in Content Area
MATH 713	Internship

After completing the Phase I coursework , a student must meet the following benchmarks: 3.0 GPA, passing Praxis II, being licensed, submitting GRE or MAT scores before continuing to Phase II of advanced studies.

Phase II: Advanced Studies (15 hours)

MATH 608	Methods of Applied Statistics
MATH 709	Discrete Mathematics
CUIN 711	Research and Inquiry
CUIN 721	Advanced Methods
CUIN 786	Assessment and Evaluation
CUIN 788	Comprehensive Examination

A MAT-Mathematics candidate must either take a written comprehensive exam in Mathematics, or submit a portfolio similar to the National Board's Portfolio, or submit a thesis to complete the Phase II study.

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 for the thesis option and a minimum of 33 semester hours of graduate credit for the project option.

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 709	Discrete Mathematics
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 713	Internship
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, Reimann 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 combinatorices. 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; two person 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 **Credit 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 709-Discrete Mathematics **Credit 3 (3-0)**
This course covers topics in discrete mathematics that are taught at the secondary school level, Topics covered include a review of logic, proofs and set theory; functions and relations; recursive and non-recursive sequences; graphs and graph albgorithms; directed graphs, trees and traversal algorithms, combinatorics; introduction to probability; and applications in political theory. Methods of teaching these topics will be discussed.

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 713- Internship **Credit 6 (0-12)**
This course is designed to provide candidates with direct on-the-job experiences relating to teaching and learning mathematics in the secondary school. It emphasizes the development and use of strategies, methods, skills, and assessment as they relate to teaching and learning mathematics. Candidates will learn to apply, plan and manage skills related to instruction. Content includes a variety if teaching strategies, methods, skills, and instructional resources.

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 Man 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, Weiserstrass-Erdmann corner conditions, Euler-Legrange 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 courser 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.

Directory of Faculty

Bampia Bangura, B. S., Njala University College; M.S., North Carolina A&T State University; Ed.D., Louisiana State University; Associate Professor, and Mathematics Education and MAT-Mathematics Graduate Coordinator

Bolindra N. Borah, B.S., Gauhat University; M.S., Ph.D., Oregon State University; Professor

Burns, D. Shea, B.S., North Carolina A&T State University; M.S., Ph.D., Howard University; Associate Professor

Gilbert Casterlow, Jr., B.S., M.S., North Carolina A&T State University; Ph.D., The Pennsylvania State University; Professor Emeritus

Mingxiang Chen, B.S., M.S., Huazhong Normal University; Ph.D., Georgia Institute of Technology; Associate Professor

Dominic P. Clemence, B.S., North Carolina A&T State University; M.S., Ph.D., Virginia Polytechnic Institute and State University; Professor

Kathy M. Cousins-Cooper, B.S., Virginia Polytechnic Institute and State University; M.S., North Carolina A&T State University; Ph.D., University of South Florida; Associate Professor

Kossi D. Edoh, B.S., Cap Coast University-Ghana; M.S., Ph.D., Simon Fraser University-Canada; Associate Professor

Gregory Gibson, B.A., State University of New York/College at Geneseo; M.S., Ph.D., North Carolina State University; Associate Professor

Alexandra Kurepa, B.S., M.S., University of Zagreb, Ph.D., University of North Texas; Professor and Applied Mathematics Graduate Coordinator

Yaw Kyei, B.S., University of Ghana; M.S., Ph.D., North Carolina State University; Assistant Professor

Liping Liu, B.S., Huazhong University of Science and Technology; Ph.D., University of Alberta; Assistant Professor

Nicholas Luke, B.S., North Carolina A&T State University; M.S., Ph.D., North Carolina State University; Assistant Professor

Alma El Morgrahby, B.S., University of Khartoum; M.S., Ph.D., Brown University; Assistant Professor

Janis M. Oldham, B.A., University of Chicago; M.S., Purdue University; Ph.D., University of California-Berkeley; Associate Professor

Yevgeniy A. Rastigeyev, M.S., Moscow Institute of Physics and Technology; M.S., Northwestern University; Ph.D., Notre Dame University; Assistant Professor

Thomas C. Redd, B.S., Fort Valley State University; M.S., University of Oklahoma; M.S., Ph.D., Brown University; Assistant Professor

John Paul Roop, B.S., Roanoke College, M.S., Ph.D.; Clemson University; Assistant Professor

Katrina Staley, B.S., M.S., North Carolina A&T State University; Ph.D. North Carolina State University; Assistant Professor

Guoqing Tang, B.S., Anhui University; M.S., Nanjing University of Science and Technology; Ph.D., Rutgers University; Professor and Interim Chairperson

Barbara Tankersley, B.S., Paine College; M.S., North Carolina A&T State University; M.S., Ph.D., Howard University; Associate Professor

Paramanathan Varatharajah, B.S., University of Jaffna; M.S., Ph.D., University of Arizona; Associate Professor

Giles Warrack, B.S., M.S., California State Polytechnic University, Ph.D., University of Iowa; Associate Professor

Nail K. Yamaleev, M.S., Ph.D., Moscow Institute of Physics and Technology; Associate Professor

Dr. Ji Y. Shen, Chairperson

PROGRAM DESCRIPTION

The School of Technology's Master of Science in Technology Management (MSTM) program started in about 1980's hosted in the Department of Manufacturing Systems, which was entitled as Master of Science Degree in Industrial Technology (MSIT) at that time and changed its title to MSTM in the Spring of 2010. The program was extended to the other three Departments within School of Technology at about 1994. There are seven concentration areas:

MS in Technology Management – Manufacturing (0255)
MS in Technology Management – Electronics and Computer (0251)
MS in Technology Management - Information Technology (0287)
MS in Technology Management - Graphic Communication Systems (0253)
MS in Technology Management - Construction Management (0252)
MS in Technology Management - Occupational Safety and Health (0254)
MS in Technology Management – Environmental and Occupational Safety (0293)

DEGREES OFFERED

Manufacturing Systems – Master of Science in Technology Management (MSTM)

ADMISSION REQUIREMENTS

Admission to the Master of Science in Technology Management, within the School of Technology, is based on the undergraduate GPA and other relevant exam scores. For the students whose undergraduate major can not match the selected area of study within MSTM concentration areas, he/she may be conditionally admitted, requiring to take some undergraduate courses in the selected area. The number of undergraduate courses will be determined by corresponding Department. No GRE is required for admission.

PROGRAM OBJECTIVES

The MSTM degree program is built upon the competencies achieved at the baccalaureate level in the technology curricula and thus enables students to secure application-oriented technology-management positions in today's industrial environment. Specifically, this program is designed to prepare technology-management professionals and enhance their proficiencies in the following areas:

- Planning, organizing and management of technology, people, and resources;
- Applying and controlling the use of various high-level technologies, e.g., information based business management systems, such as, enterprise resource planning systems, supply chain management systems, manufacturing execution systems, etc.; computer aided drafting, design and manufacturing; computer-integrated manufacturing; graphic communications systems; telecommunications and wireless communications; and machine vision and photonics.
- Construction planning and scheduling, project management, cost estimating and project management and control systems.
- Occupational safety and health assessments, safety management and control systems.
- Control processes to improve quality, reliability, and productivity.
- Human resource management and the development of a changing workplace to achieve organizational goals.
- Problem solving and creative thinking skills.

TARGET AUDIENCE AND CAREER OPPORTUNITIES

This program is designed to serve the diverse needs of people who are interested in pursing careers in technology management. Included in this group are the following:

- People currently employed in the management positions that have professional growth aspirations;
- Individuals recently completing their undergraduate study and want additional preparation prior to embarking on a career in technology management positions;

- Students interested in entering an advanced graduate degree program (i.e. Ph.D. in Technology Management) 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 technology innovation, development and deployment of new technologies across a broad spectrum of industries, planning, problem solving, and decision-making. Additionally, the program is designed to enhance student competencies in the areas of research and scholarly writing.

PROGRAM REQUIREMENTS

Total of 33 credit hours is required to receive an MSTM Degree. 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 program must maintain a minimum graduate GPA 3.0 or higher for all semesters. A student who received two "C" grades will be suspended, and a plan of action is required for re-admission.

There are two options – Project Option and Thesis Option. The Program Curriculum is as follows.

Master of Science in Technology Management (MSTM)

PROGRAM CURRICULUM

Core Courses (12 credit hours)	**Credits**
MSIT 600 Graduate Seminar	1
MSIT 701 Leadership and Technological Innovations	2
MSIT 702 Enterprise Resource Planning Systems	3
MSIT 703 Statistics and Probability in Industrial Technology	3
MSIT 704 Research Methods for Technology	3
Management Course (6 credit hours)	
MFG 614 Industrial Logistics	3
MFG 621 Manufacturing Operation Modeling	3
MFG 673 Industrial Productivity Measurement & Analysis	3
MFG 720 Industrial Economics	3
MFG 721 Industrial Operational Management	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 (6 credit hours for thesis option; 9 credit hours for project option)	
MFG 610 Six Sigma Applied to Manufacturing	3
MFG 612 Manufacturing Execution System	3
MFG 621 Manufacturing Operation Modeling	3
MFG 613 Supplier Chain Management Systems	3
MFG 651 Principles of Robotics	3
MFG 674 Advanced Automation and Control	3
MFG 681 Non-Destructive Evaluation (NDE) Technology I	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 (Select either Project or Thesis Option)

<u>Project Option</u> (6 credit hours):	
MSIT 750 Internship	3
MSIT 789 Master's Project	3
<u>Thesis Option</u> (9 credit hours):	
MSIT 705 Statistics and Probability for Research	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

Total Credit Hours: 33

COURSES DESCRIPTION IN MANUFACTURING SYSTEMS (MSTM-MFG)
Graduate Courses

MSIT-600. Graduate Seminar **Credit 1 (1-0)**
This class will cover MSIT regulations, program of study, report writing, APA publication style, colloquium preparation, research ethics, and how to utilize research resources, etc. This class needs to be taken by MSIT students in their first semester. **Prerequisite:** Graduate Standing. (F; S; Summer)

MSIT-701. Leadership and Technological Innovations **Credit 2 (2-0)**
In this course the current and evolving leadership issues will be discussed and leadership models will be presented. Managerial and leadership issues in high participation workplaces will be stressed. Students will participate in behavioral simulations and receive psychometric feedback. This course will also cover the concepts of technological innovations, including contemporary issues. **Prerequisite: MSIT-600.** (F; S; Summer)

MSIT-702. Enterprise Resource Planning Systems **Credit 3 (3-0)**
This course introduces information-based management systems, which provide a seamless integration of all the information flow through an enterprise. Topics covered include: financial and accounting information, human resource information, product planning, materials planning and purchasing, maintaining inventory, supply chain management, tracking orders, and customer network. **Prerequisite: MSIT-600.** (F; S; Summer)

MSIT-703. Statistics and Probability in Industrial Technology **Credit 3 (3-0)**
This course introduces the concepts and methods of statistics and probability applications in industrial technology. Topics include descriptive statistics, probability theory, sampling distribution, probability distributions, linear and multiple regressions, auto- and cross-correlation, and confidence intervals. **Prerequisite: MSIT-600.** (F; S; Summer)

MSIT-704. Research Methods for Industrial Technology **Credit 3 (3-0)**
This course explores empirical methodologies which are applicable to technical research. Topics covered include: problem identification, hypothesis, research design, measurements, data collection and data analysis. **Prerequisite: MSIT-600.** (F; S; Summer)

MSIT-705. Advanced Industrial Statistics and Probability **Credit 3 (3-0)**
This course is the continuation of MSIT-703 (for thesis-option students), which includes the extended applications of statistics and probability introduced in MSIT-703. Topics include hypothesis testing, statistical inferences, and non-parametric statistical methods, experiment design and data analysis. **Prerequisite: MSIT-703.** (F; S; Summer)

MSIT-750. Internship **Credit 3 (3-0)**
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-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

MSIT-788. Master's Comprehensive Exam **Credit 0 (0-0)**
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-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 704 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 704, MSIT 791 or consent of advisor.

MFG-610. Six Sigma Applied to Manufacturing **Credit 3 (3-0)**
This course introduces manufacturing students to the concepts of Six Sigma, the impact of Six Sigma on Quality of Manufacturing Industries, and the relationship between Six Sigma and total quality management. Procedures and techniques for implementing Six Sigma and case studies for its applications will be presented. Prerequisites: Graduating Standing.

MFG-611. Enterprise Resource Planning System **Credit 3 (3-0)**
This course introduces students to seamless integration of all the information flow through a company. Topics includes: financial and accounting information, product planning, parts purchasing, maintaining inventory, and tracking orders. Prerequisites: Graduating Standing.

MFG-612. Manufacturing Execution System **Credit 3 (3-0)**
This course introduces students to the Manufacturing Execution System (MES) background information; MES functionalities. Topics include: making product, turning machines on and off, measuring parts, keeping track of product schedule, inventory availability. Prerequisites: Graduating Standing.

MFG-613. Supply Chain Management Systems **Credit 3(3-0)**
This course introduces to students the functionalities and execution of Supply Chain Management (SCM) systems. In addition, it shows how information technology and Internet can be integrated into manufacturing management process. Prerequisite: Graduating Standing. **(F; S)**

MFG-614. Industrial Logistics **Credit 3(3-0)**
This course focuses on the planning, organizing, and controlling of physical distribution, materials management, transportation management, logistics, supply chain. Concepts, principles, and methods to make products and services available to customers at the time, place, and in the condition and form desired, in the most profitable and cost-effective way will be introduced. **Prerequisite:** Graduating Standing. **(F; S; Summer)**

MFG-621. Manufacturing Operation Modeling **Credit 3(3-0)**
This course is to provide students with a conceptual understanding of the roles that the quantitative methods play in the decision-making process. It describes many quantitative methods used in manufacturing and how the decision makers can apply these methods to develop manufacturing operation models. **Prerequisite:** Graduating Standing. **(F; S; Summer)**

MFG-650. Thermal and Vibration Analysis and Testing of Electronic Components Credit 3(3-0)
This course covers topics in electronic components testing including failure mode, overheating, thermal stress and vibration analysis. Environmental stress screening including thermal and vibration cycling will also be studied. Prerequisite: Graduating Standing. **(F; S)**

MFG-651. Principles of Robotics Credit 3 (2-2)
This course emphasizes the study of robotics principles and logic control manipulators towards the total integration into a flexible manufacturing system.

MFG-673. Industrial Productivity Measurement and Analysis Credit 3 (2-2)
Study of work measurement and method analysis towards establishing work standards and measuring productivity in industries. (F;S)

MFG-674. Study of Automation and Control Systems Credit 3 (2-2)
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-681. Non-Destructive Evaluation (NDE) Technology I 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.

Prerequisite: Graduating Standing. **(F; S)**

MFG-682. Non-Destructive Evaluation (NDE) Technology II Credit 3 (2-2)
This course introduces the newly developed NDE technologies, such as acoustic emission techniques, magnetic flux leakage technique, radiographic, and microwave techniques. For each technique a series of topics covering physical principles, testing procedures, data collection and analysis and applications will be introduced.
Prerequisite: MFG-681. **(F; S)**

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 sensoring 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-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 (2-2)
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-720. Industrial Economics **Credit 3(3-0)**
In this course students will be introduced to the concepts of industrial economics and theory including: people's behavior in producing, consuming, and exchanging goods and services; supply and demand; business economics behavior; government's role in economic behavior; and gross national product. **Prerequisite:** MSIT 600, MFG 621. **(F; S; Summer)**

MFG-721. Industrial Operational Management **Credit 3(3-0)**
The course focuses on competitive management of an industrial organization, which provides products and/or services. Topics covered in this course include product process design, inventory management, quality management, forecasting and quality control. **Prerequisite:** MSIT 600, MFG 621. **(F; S; Summer)**

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.

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.

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 MFG Process/Computer Numerical Control (CNC) **Credit 3 (3-0)**
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 mo9st comm9on 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.

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 (0-0)**
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)**

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.

MFG-999. Continuation of Master's Thesis in Manufacturing Technology **Credit 1 (1-0)**
This course provides additional time for thesis-option students to complete approved research for the thesis. Prerequisites: MSIT 791 and MSIT 792 or consent of advisor.

Graduate Faculty

Department: Manufacturing Systems
Chairperson: Dr. Ji Y. Shen

Alton L. Kornegay, Assistant Professor and Graduate Program Coordinator, B.S., Savannah State University; MBA, University of Iowa; Ph.D., Iowa State University

Hany K. Nakhla, Associate Professor, B.S. and M.S., Cairo University in Egypt; Ph.D., Rensselaer Polytechnic Institute, Troy, New York

Zhaoqiong (Julie) Qin, Associate Professor, B.S., Southwest Jiaotong University; M.S., Southwest Jiaotong University; Ph.D., New Jersey Institute of Technology

Ji Y. Shen, Associate Professor and Interim Chair, B.S., Northwestern Polytechnic University; M.S., Nanjing Aeronautical University; Ph.D., Old Dominion University

Earnest L. Walker, Professor and Associate Dean, B.S., A.M. & N. College; M.S., University of Arkansas, Fayetteville; Ph.D., Southern Illinois University at Carbondale

Mechanical Engineering

Samuel Owusu-Ofori, Department Chairperson (Interim)
http://www.eng.ncat.edu/dept/mcen/

OBJECTIVE

The objective of graduate study in Mechanical Engineering is to provide advanced level study in distinct areas of specialization. The Master of Science in Mechanical Engineering prepares the graduate student 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 independent research opportunities and skills to students who are interested in research and teaching at the university level.

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 comprises 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 recognized institutions. Applicants may be admitted to the MSME Program unconditionally or conditionally.

1. *Unconditional Admission:* An applicant may be given unconditional admission to the MSME Program if he/she possesses a Bachelor of Science in Mechanical Engineering degree from an accredited institution with an overall GPA of 3.0 or better on a 4.0 scale. Students admitted on an unconditional basis are expected to have completed "key fundamental courses" listed below as part of their undergraduate program.
   Strength of Materials
   Materials Science and Engineering
   Thermodynamics
   Fluid Mechanics
   Mechanical Engineering Design
   Heat Transfer

2. *Conditional Admission:* An applicant may be granted conditional admission if he/she has one or more of the following situations:
   a. Applicant has a baccalaureate mechanical engineering degree with a GPA of less than 3.0 but has at least a 3.0 GPA in the last four semesters of undergraduate study.
   b. Applicant has a baccalaureate degree in engineering with a 3.0 GPA or better on a 4.0 scale but is deficient in key fundamental courses as listed in the previous section. These deficiencies must not exceed 12 credit hours.
   c. Applicant has a non-engineering but a closely-related undergraduate degree with a substantial engineering science content and a GPA of 3.0 or higher. Background deficiencies should not exceed 12 credit hours.

Change of Admission Status

Conditionally admitted students will be changed to unconditional when the two conditions below are satisfied.

a. All proscribed course deficiencies have been completed with a 3.0 GPA or higher 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.

It is the student's responsibility to move to unconditional admission status when first eligible will result in the student being subjected 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. Conditional admission status is the minimum level of graduate admission classification.

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 credits for any completed graduate courses. Such students also run the risk of academic probation and dismissal.

Program Options
Three options are available to MSME students: thesis option, project option, and course work option.

Thesis Option
Students in the Thesis Option must take six (6) credit hours of Thesis (MEEN 797) in addition to twenty-four (24) credit hours of course work with letter grades. At least twelve (12) credit hours of those 24 credit hours must be at the 700 level and above. An original research topic must be chosen in conjunction with the student's major advisor and thesis advisory committee culminating in the production 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. Refer to the current Mechanical Engineering Graduate Catalog for more information.

Project Option
Students in the Project Option must take three (3) credit hours of Master's Project (MEEN-796) in addition to thirty (30) credit hours of course work with letter grades. At least fifteen (15) credit hours of those 30 credit hours must be at the 700 level and above. The option is intended for students who have substantial engineering experience. An oral examination project defense/examination is required. Refer to the current Mechanical Engineering Graduate Catalog for more information.

Course Work Option
Students in the Course Work Option must pass a comprehensive examination (MEEN 788) in addition to thirty-three (33) credit hours of course work with letter grades. At least eighteen (18) credit hours of those 33 credit hours must be at the 700 level and above. A student selecting the Course Work Option must receive approval from the Department Chair. A student in this option is not eligible to receive campus based scholarship, tuition waivers, or assistantships. Refer to the current Mechanical Engineering Graduate Catalog for more information.

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 institutions, government research laboratories and industries, and 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 study under the guidance of the academic advisor and on the dissertation committee in formulating a plan of study, in setting and meeting the degree goals, and in selecting a dissertation topic. The academic advisor guides the student during the dissertation phase of the program.

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 with minimum 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 of scholarship in a specialized field of study. As a guide, however, the student is expected to complete at least twenty-four (24) course credits beyond the master's degree, a minimum of twelve (12) dissertation credits, a specified number of credit hours in supervised research as determined by the dissertation committee, and doctoral

seminars as specified by the department. The student must demonstrate both the attainment of scholarship and independence in a specialized area by writing a dissertation on an original research. The student must pass a written qualifying examination, an oral preliminary examination and a final defense of the dissertation. See the current Mechanical Engineering Graduate Handbook for more information.

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, together with the student, will 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.

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. Plagiarism is not tolerated and will be severely dealt with. Any student involved in plagiarism will be expelled from the program.

The dissertation will be reviewed by all members of the dissertation committee and must receive their approval prior to submission to the School of Graduate Studies. The major advisor and the dissertation committee are responsible for the technical content, grammar, sentence construction, consistency, and formatting. Three copies of the dissertation signed by all members of the student's dissertation 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.

DIRECT BS TO PH.D. PROGRAM

The direct BS to PhD program is designed to attract outstanding and well motivated students into the Ph.D. program. A student with a BSME degree from an accredited program with a 3.5 GPA or higher, a GRE score of 1100 or higher, and strong reference letters may be admitted to this program. Students in this program must qualify for unconditional admission. A directly admitted PhD student is expected to complete at least forty-two (42) course credits beyond the bachelor's degree and a minimum of eighteen (18) dissertation credits. Students who fail the qualifying examination in two attempts will be evaluated and recommended to receive the Master's degree and will be dismissed from the Ph.D. program. **Refer to the current Mechanical Engineering Graduate Catalog for more details.**

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 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	Turbomachinery
MEEN 675	Solar Energy Fundamentals and Design
MEEN 680	Applied Statistics in Mechanical System Design
MEEN 685	Special Topics
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 Computer Aided 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 788	Masters Comprehensive Examination
MEEN 792	Master’s Seminar
MEEN 793	Master’s Supervised Teaching
MEEN 794	Master’s Supervised Research
MEEN 796	Master’s Project
MEEN 797	Master’s Thesis
MEEN 799	Continuation of Master’s Thesis/Project
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 991	Doctoral Qualifying Examination
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 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 431or 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 Langrangian methods of body problems, generalized variables, small vibrations, and gyroscopic effects and stability. Prerequisites: MEEN 337, MATH 431or 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 micromeasurement techniques applied to structural models are also addressed. Prerequisites: 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 431, 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 360 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 431 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 431 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 360 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-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 **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 336 and MEEN 474.

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 540, 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 431, MEEN 337, and MEEN 415.

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 476.

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 431 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 462 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 415 or MEEN 416 and MEEN 442 or MEEN 476.

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 or MEEN 476 and MEEN 462.

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 or MEEN 476.

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 or MEEN 476.

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 462.

MEEN 680. Applied Statistics in Mechanical System Design **Credit 3(3-0)**
This course deals with the statistical nature of design and performance of mechanical systems. This includes statistical methods for evaluation of safety margin and factor of safety for static and fatigue loading, accuracy, precision, life and reliability of mechanical components and systems. Team projects are assigned. Prerequisite: MEEN 210, MEEN 474, or Consent of Instructor. (DEMAND)

MEEN 685. 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. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor. (DEMAND)

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 540, MATH 431, 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 462 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 462 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 462 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 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 431or 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-799 - Continuation of Master's Thesis/Project **Credit 1 (1-0)**
This course is for master's students who have completed all required credit hour requirements. Prerequisite: Completion of all course work and thesis/project Credits.

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 462 or equivalent.

MEEN-838. Solar Thermal Energy Systems **Credit 3 (3-0)**
Characteristics 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 445 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 instructor.

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 991. Doctoral Qualifying Examination **Credit 3 (3-0)**
This supervised program is for students who are taking the department Qualifying Examination to demonstrate their understanding of the fundamental principles of mechanical engineering and their ability to apply these principles to solve mechanical engineering problems. It culminates in a scheduled written exam administered on a Pass/Fail basis and must be passed prior to the end of the third semester. Prerequisites Doctoral student in Mechanical Engineering with unconditional admission status and consent of academic advisor

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: Must have passed Doctoral Qualifier Exam.

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 Dissertation for Mechanical Engineering **Credit 1 (1-0)**
The course is for doctoral students who have completed all required credit hour requirements. Prerequisite: Completion of all Thesis/Dissertation Credits.

Directory of Faculty

DeRome O. Dunn…………………………… ....Associate Professor
B.S., M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University
Frederick Ferguson………………………………. ....Professor and Director of Center for Aerospace Research
M.S., Kharkov State University; Ph.D., University of Maryland
Arturo Fernandez ……………………...Assistant Professor
B.Eng., Ph.D., Universidad Politecnica de Madrid
John Kizito ....Assistant Professor
B.S., Makerere University, Uganda; M.S., Ph.D., Case Western Reserve University
Dhananjay Kumar .... Associate Professor and ORNL Joint Faculty

B.S., Bhagalpur University; M.S., Magadh University, Ph.D., Indian Institute of Technology

Samuel P. Owusu-Ofori..Boeing Professor and Interim Chairperson

B.S., University of Science and Technology-Kumasi, Ghana; M.S., Bradley University; Ph.D., University of Wisconsin-Madison; Professional Engineer

Devdas M. Pai…..Professor and Associate Director, NSF Engineering Research Center

B.Tech., Indian Institute of Technology Madras; M.S., Ph.D., Arizona State University; Professional Engineer

Messiha Saad..Assistant Professor

B.S., Suez Canal University; M.S., North Carolina A&T State University; Ph.D., North Carolina State University

Jagannathan Sankar.. **University Distinguished Professor and Director, NSF Engineering Research Center**

B.E., University of Madras; M.E., Concordia University, Ph.D., Lehigh University

Kunigal N. Shivakumar...Research Professor and Director of Center of Aviation Safety

B.E., Bangalore University; M.E., Ph.D., Indian Institute of Science

Ronald C. Steed Assistant Professor

BSc, Duke University, M.E., Ph.D., University of Florida

Mannur Sundaresan... Professor and Graduate Program Coordinator

B.E , M.E., Bangalore University, Bangalore, India, Ph.D., Virginia Polytechnic Institute & State University

Shih-Liang Wang...Professor and Undergraduate Program Director

B.S., National Tsing Hua University; M.S., Ph.D., Ohio State University; Professional Engineer

Sun Yi ....Assistant Professor

B.S., Seoul National University; M.S., Ph.D., University of Michigan-Ann Arbor

Natural Resources and Environmental Design

Louis E. N. Jackai, Chairperson
238 Carver Hall
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lejackai@ncat.edu

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, Integrated Pest Management, Constructed Wetlands, and Applied Fungal Biology and Biotechnology. 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 Sciences

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 School 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). A GRE score of 1000 is required.

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

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 area of 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 following courses.
AGRI 604 Experiment Methods in Research 3 Credit Hours
NARS 720 Graduate Seminar in Natural Resources 2 Credit Hours
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.

Curriculums offered in Plant, Soil and Environmental Science – M.S. Program

Plant Sciences Concentration

Course	Title	Credit Hours
ANSC665	Techniques in Biotechnology	3
*AGRI604	Experimental Methods in Research	3
BIOL704	Cell and Molecular Biology	3
HORT610	Commercial Greenhouse Production	3
HORT700	Plant Biotechniques	3
NARS777	Special Problems in Plant Sciences Graduate Studies	3
*NARS720	Graduate Seminar in Natural Resources	2
NARS799	Thesis	6
SLSC717	Methodology in Plant, Soil and Water Analysis	3
EES 785	Mycology	3
EASC718	Applied Environmental Microbiology	3
HORT620	Vegetable Production	3
HORT612	Integrated Pest Management (IPM) Systems	3
Total		**41**

Environmental Science Concentration

Course	**Title**	**Credit Hours**
*NARS720	Graduate Seminar in Natural Resources	2
EASC622	Environmental Sanitation and Waste Management	3
EASC610	Sustainable Earth (online)	3
SLSC640	Wetland Management	3
*AGRI604	Experimental Methods in Research	3
EASC616	Natural Resource Conservation	3
SLSC634	Soil Chemistry	4
SLSC717	Methodology in Plant, Soil, and Water Analysis	3
*NARS720	Graduate Seminar in Natural Resources	1
NARS799	Graduate Thesis	6
SLSC715	Soil Mineralogy	3
EASC718	Applied Environmental Microbiology	3
EES785	Mycology	3
SLSC621	Soil Microbiology	3
HORT612	Integrated Pest Management (IPM) Systems	3
Total		**46**

Soil Science Concentration

Course	Title	Credit Hours
SLSC 715	Soil Mineralogy	3
*AGRI 604	Experimental Methods in Research	3
SLSC 717	Methodology in Plant, Soil, and Water Analysis	3
SLSC 621	Soil Microbiology	4
SLSC 634	Soil Environmental Chemistry	4
SLSC 727	Soil Fertility & Plant Nutrition	3
SLSC 632	Soil Physics	3
SLSC 633	Soil Genesis, Classification and Land Use	4
*NARS 720	Graduate Seminar in Natural Resources	2
NARS 799	Graduate Thesis	6
EASC616	Natural Resource Conservation	3
Total		**38**

COURSES WITH DESCRIPTION IN
NATURAL RESOURCES AND ENVIRONMENTAL DESIGN

Plant, Soil and Environmental Science
Advanced Undergraduate and Graduate

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-610. Sustainable Earth **Credit 3(3-0)**
The topics addressed in this course include global climate change, ocean habitat and productivity, sustainable food production, and safe and pure drinking water. Students will focus on environmental issues, and they will examine present options with a perspective of how we may influence or be influenced by these issues in the future.

EASC-620. Environmental Studies I **Credit 3(3-0)**
This course provides a multidisciplinary approach to several global, regional, and local environmental issues. These issues will be examined from a variety of perspectives; scientific, technical, social, political, economic, legal and ethical. A combination of in-class and out-of-class activities will provide the basis for research projects.

EASC-621. Environmental Studies II **Credit (4-0)**
Students will be involved in role-playing exercises in which small groups of students will represent government or interest groups in a town meeting that will discuss a controversial environmental issues. Students will also participate in field trips that will provide an understanding of the complexities of environmental issues and will present a formal report.

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-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)

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-610. 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-612. Integrated **Pest Management (IPM) Systems** **Credits 3 (2-3)**
This course builds on the basics of applied entomology, plant pathology and weed science to develop the skills necessary for the management of pests attacking man and his domesticated animals, turf, ornamentals, vegetables and crop systems.

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 (2-2)**
This course will examine methodology of in vitro plant culture systems, genetic transformation, current development in plant biotechnology, and societal and economic impacts.

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 damsor embankments will be covered. Prerequisite: AGEN-600 or consent of the instructor.

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 2 (2-0)**
This course prepares students to develop and write proposals and the thesis resulting from their research. Students will also learn how to present their data at seminars and prepare them for publication in peer-reviewerd journals. Each student will generally present two or more seminars during the course, one of which will be on their proposal and others on assigned scientific publications. It is mandatory for all graduate students in the department.

NARS-777. Special Problems **Credit 3 (3-0)**

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.

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)

Graduate Faculty:
Department: Natural Resources and Environmental Design
Chair: Dr. Louis E. N. Jackai
M.R. Reddy, B.S., Osmania University; M.S., A.P.A.U. (India); Ph.D., University of Georgia; Professor, Graduate Program Coordinator
G.A. Gayle, B.S., North Carolina A&T State University; M.S., Ph.D., N.C. State University; Professor
Dr. L.E.N. Jackai. B.S., University of Cape Coast, Ghana, M.S., University of Wisconsin - Superior, Ph. D. University of Illinois Urbana-Champaign, Professor and Chair
M. Kamp-Glass, B.S., Texas Tech University; M.S., Ph.D., Texas A&M University; Professor
O. Isikhuemhen, B.S., M.S., University of Benin, Nigeria; Ph.D. Institute of Microbiology, Prague, Czech Republic, Adjunct Associate Professor
C.W. Raczkowski, B.S., M.S., Kansas State University; Ph.D., N.C. State University; Adjunct Associate Professor
G.B. Reddy, B.S., M.S., A.P.A.U. (India); Ph.D., University of Georgia; Professor
Manuel R. Reyes, B.S., University of the Philippines at Los Banos; M. Phil., Cranfield Institute of Technology, England; Ph.D., Louisiana State University; Associate Professor
A. Shahbazi, B.S., University of Tabriz; M.S., University of California, Davis; Ph.D., Pennsylvania State University; Professor
G.A. Uzochukwu, B.S., M.S., Oklahoma State University; Ph.D., University of Nebraska; Professor
G. Yang, B.S., Jilin Agricultural University; M.S., Ph.D., University of Nebraska-Lincoln; Adjunct Associate Professor
Dr. A. Diouf, B.S., Dakar University, Senegal, M.S., Ph.D., Graduate Center, City University of New York, Assistant Professor
Dr. L. Wang, B.S. Zhengzhou University, M.S. South China University, Ph.D. National University of Ireland, Assistant Professor

Physics

Abdellah Ahmidouch, Chairperson
101 Marteena Hall
(336) 285-2105

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, and problem solving. The Masters of Science program in Physics prepares students for professional careers in industrial and governmental research, developmental applications of physics, teaching, and further study toward a Ph.D. in physics.

RESEARCH PROGRAMS AND FACILITES

The Department of Physics has 10 full-time faculty and several adjunct faculty and research associates that participate in seven funded research areas. To support these efforts, the department receives over $3.2 Million per year in research funds. Each year, faculty and students publish an average of 20 refereed articles and make over 100 presentations at national and international conferences.

The seven research groups in the department include:

a. Experimental Low and Medium Energy Physics: Research carried out on campus, at the Thomas Jefferson National Accelerator Facility, and at the Triangle Universities Nuclear Laboratories. Research topics include: investigations of the spin structure of the nucleon, tests of fundamental symmetry-breaking predictions in the theory of the strong force through precision measurement of meson decay widths, and signature of materials by gamma exposure. The research work involves construction of detectors, data acquisition, test and calibrations, and data analysis. The research work is supported by the National Science Foundation.
b. Atmospheric Science: The research and technology integrated themes include: sensor science and technology, data mining and analysis, and global observing systems. This research is supported by a grant from the National Oceanic and Atmospheric Administration.
c. Chemical Physics, Experimental and Theoretical: Spectroscopic techniques applied to the study of chemical reactions, non reactive energy transfer processes, and cluster photochemistry, as well as theoretical calculations involving density matrix functional theories. Program supported by the National Science Foundation.
d. Physics of Materials: Experimental and theoretical research into the physical properties of amorphous, ordered, and nanostructured solids. Investigated materials include metals, insulators, semiconductors and amorphous solids.
e. Physics Education: Space and Earth Science Education development supported through a NASA grant. Research on the ionospheric phenomenon along the geomagnetic equator Also, research on web-based education and innovative teaching methods and on creating a responsive learning environment.
f. Seismic Data Processing: Research in seismic physical modeling, seismic data analysis, subsurface imaging, and non-destructive testing using ultrasonic waves. This research is supported by the National Science Foundation.
g. Computational Atomic Molecular and Optical Physics: Structural studies of organic molecular crystals. Visualization of DFT functional differences.

The department has strong and active collaborations with major research institutions such as Duke University, the University of North Carolina at Chapel Hill, North Carolina State University, Wake Forest University, Stanford University, Pennsylvania State University, Hampton University, the University of Virginia and others. Collaborations with national laboratories include the Thomas Jefferson National Accelerator Facility (JLab), NOAA-Earth System Research Laboratory (NOAA-ESRL), Lawrence Berkeley National Laboratory (LBNL), National High Magnetic Field Lab-Florida, Los Alamos National Laboratory (LANL), and Oak Ridge National Laboratory (ORNL). International collaborations include the University of Marseilles in France, the Addis Ababa University in Ethiopia, ITEF Moscow, Russia, and the Institute for High Energy Physics at Protvino, Russia.

DEGREES OFFERED

Master of Science in Physics

Through a careful selection of electives, a student can pursue a track that provides a comprehensive preparation needed to pursue a Ph.D. in physics or related areas, or an applied physics track that provides opportunities for interdisciplinary studies and research in atmospheric sciences and meteorology, other sciences, engineering, or mathematics.

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 an 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 physics-related disciplines.

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, Electromagnetism, Quantum Mechanics, 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.

CURRICULUM GUIDE FOR M.S. IN PHYSICS

First Year

First Semester		**Credit**	**Second Semester**		**Credit**
PHYS 600	Classical Mechanics	3	PHYS 630	Statistical Mechanics	3
PHYS 615	Fund. Of Electromagnetism	3	Elective		3
PHYS 620	Quantum Mechanics I	3	Elective		3

Second Year

First Semester		**Credit**	**Second Semester**		**Credit**
Elective		3	Elective		3
PHYS 791	M.S. Project	3	PHYS 791	M.S. Project	3
Or			Or		
PHYS 792	M.S. Thesis	1-6	PHYS 792	M.S. Thesis	1-6
Or			Or		
Two PHYS Electives		6	PHYS Elective		3

Physics Core Required Courses include:
PHYS 600 Classical Mechanics
PHYS 615 Fundamentals of Electromagnetism

PHYS 620 Quantum Mechanics I
PHYS 630 Statistical Mechanics

Electives:
To be determined by the student's interest and approved by the student's advisor and/or the Graduate coordinator. The list of electives includes (but is not limited to): PHYS 651, PHYS 680, PHYS 695, PHYS 715, PHYS 720, PHYS 735, PHYS 736, PHYS 737, and PHYS 738.

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*	Fundamentals of Electromagnetism	3 (3-0)
PHYS 620*	Quantum Mechanics I	3 (3-0)
PHYS 630*	Statistical Mechanics	3 (3-0)
PHYS 651	Advanced Astrophysics	3 (3-0)
PHYS 680	Advanced Solar Physics	3 (3-0)
PHYS 695	Space and Atmospheric Science	3 (3-0)
PHYS 715	Advanced Electromagnetism	3 (3-0)
PHYS 720	Quantum Mechanics II	3 (3-0)
PHYS 730	Optical Properties of Matter	3 (3-0)
PHYS 735	Physics of Atoms, Molecules and Nanosystems	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 IN PHYSICS WITH DESCRIPTIONS

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: PHYS 401or Graduate standing.

PHYS 601 Special Topics in Geophysics **Credit 3 (2-2)**

This is a graduate and/or advanced undergraduate course on selected topics in applied and computational geophysics. A descriptive title and syllabus must have departmental approval prior to scheduling the course. Students' records will carry both course number and descriptive title. The course may be repeated to earn a maximum of six credit hours. Prerequisite: permission of instructor and senior or Graduate standing.

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 activties 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.

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, and Green functions. Prerequisite: Graduate standing or consent of instructor.

PHYS 615. Fundamentals of Electromagnetism **Credit 3 (3-0)**
This course covers the essentials of classic electromagnetism: electrostatics, Laplace's equations, multipole expansion, electric polarization and dielectrics, magnetostatics, magnetization, Faraday's law of induction, and Maxwell's equations. Prerequisite: PHYS 416 or Graduate standing.

PHYS 620. Quantum Mechanics I **Credit 3 (3-0)**
This course covers the basic theory and postulates of quantum mechanics with applications to one-dimensional potential problems. The one electron atom, theory of angular momentum, perturbation theory, approximation methods, and the matrix formalism of quantum mechanics will be covered. Prerequisite: Senior 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: PHYS 430 or Graduate standing.

PHYS 651. Advanced Astrophysics **Credit 3 (3-0)**
This course is a study of radiation from stars and nebulae to determine the basic stellar characteristics and the composition and physical conditions of matter in and between the stars. It also investigates the structural properties of our Milky Way galaxy, as evidenced by the spatial distribution. Prerequisite: Senior or Graduate standing.

PHYS 680. Advanced Solar Physics **Credit 3 (3-0)**
This course is an advanced study of solar physics. It covers topics such as the Sun as a star, solar photosphere and outer convection zone, granulation and related phenomena, solar chromosphere and corona, sun's radio emission, solar-terrestrial relations, and magnetic structure. It also treats the theory of convection, wave motion in the presence of magnetism and gravity, coronal heating theories, steady and nonsteady flows, dynamo theory, and the theory of solar flares and other transient phenomena. Prerequisite: Senior or Graduate standing.

PHYS 695. Space and Atmospheric Science **Credit 3 (3-0)**
This course is a study of space and atmospheric science. It includes space-based operation, remote sensing studies of the Earth and distant objects, in-situ measurement of the space environment, composition of the Earth's atmosphere, application of thermodynamics to atmospheric problems, and development of the fundamental equations of fluid motion. Applications to synoptic scale atmospheric circulations, boundary layer effects, global circulation, and physical meteorology are also treated. Prerequisite: Senior or Graduate standing.

PHYS 715. Advanced Electromagnetism **Credit 3 (3-0)**
This course is an advanced study of electromagnetic phenomena: plane electromagnetic waves and wave propagation, wave guides and resonant cavities, radiating systems, radiation by moving charges, special theory of relativity, and applications of electromagnetic theory. Prerequisite: PHYS 615.

PHYS 720. Quantum Mechanics II **Credit 3 (3-0)**
This course covers applications of quantum mechanics to atomic, molecular, nuclear, solid state and semiconductor physics. Prerequisite: PHYS 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. Physics of Atoms, Molecules and Nanosystems **Credit 3 (3-0)**
This course is a study of one- and many-electron atoms, and the molecular structure and spectra of diatomic and polyatomic molecules with introductory applications to nanoscience. The course also covers other topics that include the quantum nature of the nanoworld and self-assembled nanostructures in nature and industry. Prerequisite: 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: PHYS 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: PHYS 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 be 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 PHYS 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: PHYS 720 or Graduate standing.

PHYS 751. Relativistic Quantum Mechanics II **Credit 3 (3-0)**
A continuation of PHYS 750. Prerequisite: PHYS750.

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 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. Prerequisite: 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.

Directory of Faculty

Abdellah Ahmidouch.. **Professor and Chairperson**
B.S., Mohammed V. University; M.S., Joseph Fourier Grenoble I University; Ph.D., University of Geneva
Solomon Bililign.. **Professor**
B.S., M.S., Addis Ababa University; Ph.D., University of Iowa
Samuel S. Danagoulian.. **Professor**
M.S., Ph.D., Yerevan Physics Institute
Kenneth Flurchick.. **Assistant Professor**
Ph.D.,Colorado State University
Ashot Gasparian.. **Professor**
B.S., Ph.D., Yerevan Physics Institute
Floyd J. James.. **Associate Professor**
B.S., M.S., University of North Carolina; Ph.D., University of North Carolina at Chapel Hill
Abebe B. Kebede.. **Associate Professor**
B.S., Addis Ababa University; M.A, Ph.D., Temple University
Ilki Kim.. **Adjunct Associate Professor**

B.S., Seoul National University, M.S., University of Hamburg, Ph.D., University of Stuttgart
Melvin Levy... **Research Professor**
B.S., M.A., Queens College, Ph.D., Indiana University
Yuh-Lang Lin...**Professor**
B.S., Fujen Catholic University, M.S., South Dakota School of Mines and Tech., Ph.D., Yale University
Ronald S. Pedroni.. **Associate Professor**
B.A., Jacksonville University; Ph.D., Duke University
Thomas R. Sandin.. **Professor Emeritus**
B.S., Santa Clara University; M.S., Ph.D., Purdue University
Jing Zhang……………………………………………………...………………………..…**Associate Professor**
B.S., M.S., University of Nanjing, Ph.D. Perking University, China

Social Work

Joint Master of Social Work Program*
Department of Sociology & Social Work
Dr. Arnold Barnes (NCA&TSU), Co-Director - 336-285-2293
Prof. Susan Dennison (UNCG), Co- Director - 336-334-4099

The Joint Master of Social Work (JMSW) program represents the efforts of faculty and administrators at North Carolina Agricultural and Technical State University (NCA&TSU) and the University of North Carolina at Greensboro (UNCG). 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.

Successful completion of the degree requires 60 credit hours. 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.

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 two advanced generalist practice areas: families and youth at-risk or health/mental 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.

ADVANCED STANDING

Students in the Advanced Standing plan of study begin their graduate coursework in the summer taking 12 credit hours of course in two sessions. This coursework builds a content bridge between Bachelor of Social Work coursework and the advanced year curriculum of the JMSW Program.

COURSE OF STUDY AND DEGREE REQUIREMENTS

The JMSW Program requires successful completion of 60 credit hours. Completion of the program requires full time enrollment by students in the **two-year plan of study**. The program offers a foundation year and a second year of concentration content for advanced practice.

First Year Foundation Courses (30 Hours)

NCA&TSU			UNCG
First Semester		**15 Credit Hours**	
SOWK 700	Human Behavior and Social Functioning I	3	SWK 620
SOWK 701	Social Welfare Policy and Analysis I	3	SWK 621
SOWK 703	Social Work Practice with Individuals and Families	3	SWK 622
SOWK 704	Social Work with Groups	3	SWK 623
SOWK 705	Social Work Practice and Human Diversity	3	SWK 624
		15	
Second Semester		**15 Credit Hours**	
SOWK 702	Human Behavior and Social Functioning II	3	SWK 625
SOWK 707	Social Work Research Methods I	3	SWK 626
SOWK 708	Social Work Practice with Communities and Organizations I	3	SWK 627
SOWK 709	Field Education I	5	SWK 628
SOWK 719	Field Seminar I	1	SWK 629
		15	

Second Year- Advanced Curriculum (30 Hours)

First Semester Area of Practice Course Credit			
SOWK 706	Social Policy and Welfare Analysis II	3	SWK 633
SOWK 710	Social Work with Families and Youth at Risk I **or**	3	SWK 637
SOWK 712	Social Work in Health and Mental Health I		SWK 638
SOWK 718	Research Designs & Data Analysis for Social Work Practice		SWK 634
SOWK 722	Field Education II	5	SWK 635

SOWK 721	Field Seminar II	1	SWK 636
		15	
Second Semester Area of Practice Course Credit			
SOWK 711	Social Work with Families and Youth at Risk II **or**	3	SWK 642
SOWK 713	Social Work in Health and Mental Health II		SWK 643
SOWK 716	Social Work in Administration	3	SWK 639
Elective		3	
SOWK 723	Field Education III	5	SWK 640
SOWK 725	Field Seminar III	1	SWK 641
		15	
Total Hours		**60**	

Students in the **three-year plan of study** complete the JMSW Program according to the following curriculum sequence:

Year One (15 Credits)
First Semester (Summer – 3 Credits)
SOWK 701 Social Welfare Policy and Analysis I (3)

Second Semester (Fall – 6 Credits)
SOWK 700 Human Behavior and Social Functioning I (3)
SOWK 703 Social Work Practice with Individuals and Families (3)

Third Semester (Spring – 6 Credits)
SOWK 704 Social Work with Groups (3)
SOWK 705 Social Work Practice and Human Diversity (3)

Year Two (18 Credits)
First Semester (Summer – 6 Credits)
SOWK 709 Field Education I (5)
SOWK 719 Field Seminar I (1)

Second Semester (Fall – 6 Credits)
SOWK 702 Human Behavior and Social Functioning II (3)
SOWK 708 Social Work Practice with Communities and Organizations I (3)

Third Semester (Spring – 6 Credits)
SOWK 706 Social Policy and Welfare Analysis II (3)
SOWK 707 Social Work Research Methods I (3)

Year Three (27 Credits)
First Semester (Summer – 3 Credits)
SOWK 716 Social Work in Administration (3 Credits)

Second Semester (Fall – 12 Credits)
SOWK 710 Social Work with Families and Youth at Risk I (3) **or**
SOWK 712 Social Work in Health and Mental Health I (3)
SOWK 718 Research Designs & Data Analysis for Social Work Practice (3)
SOWK 722 Field Education II (5)
SOWK 721 Field Seminar II (1)

Third Semester (Spring – 12 Credits)
SOWK 711 Social Work with Families and Youth at Risk II (3) **or**
SOWK 713 Social Work in Health and Mental Health II
Elective (3)
SOWK 723 Field Education III (5)
SOWK 725 Field Seminar III (1)

The **Advanced Standing plan of study** of the MSW Program is a one-year plan of study consisting of 42 credits that will require full time enrollment by students with Bachelor of Social Work Degrees. The program requires completion of four bridge/transition courses in the summer followed by a year of concentration content for advanced practice.

Summer Bridge/Transition Course (12 Hours)

NCA&TSU			UNCG
SummerSemester I		**6 Credit Hours**	
SOWK 705	Social Work Practice and Human Diversity	3	SOWK 624
SOWK 731	Social Work with Individuals and Families: Theory, Behavior, & Practice	3	SOWK 631
		6	
Summer Semester II		**6 Credit Hours**	
SOWK 707	Social Work Research Methods I	3	SOWK 626
SOWK 732	Social Work with Groups, Communities, & Organizations	3	SOWK 632
		6	

Second Year –Advanced Curriculum (30 Hours)

NCA&TSU			UNCG
First Semester Area of Practice Course Credit			
SOWK 706	Social Policy and Welfare Analysis II	3	SWK 633
SOWK 710	Social Work with Families and Youth at Risk I **or**	3	SWK 637
SOWK 712	Social Work in Health and Mental Health I		SWK 638
SOWK 718	Research Designs & Data Analysis for Social Work Practice		SWK 634
SOWK 722	Field Education II	5	SWK 635
SOWK 721	Field Seminar II	1	SWK 636
		15	
Second Semester Area of Practice Course Credit			
SOWK 711	Social Work with Families and Youth at Risk II **or**	3	SWK 642
SOWK 713	Social Work in Health and Mental Health II		SWK 643
SOWK 716	Social Work in Administration	3	SWK 639
Elective		3	
SOWK 723	Field Education III	5	SWK 640
SOWK 725	Field Seminar III	1	SWK 641
		15	
Total Hours		**42**	

ADMISSIONS

Admissions for the JMSW program rotates between the two campuses every four years. 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 3.0 grade point average or better in the undergraduate major;
3. 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.

Applicants to the Advanced Standing plan of study must have earned a Bachelor of Social Work degree from a Council on Social Work Education accredited program, have a GPA in social work courses of 3.2 or better, and provide a letter of recommendation from his/her B.S.W. field supervisor (as one of the three recommendations required).

The program admits students only once a year for Summer and 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) 285-2049. All inquiries concerning admission for Fall 2008 and Fall 2009 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.

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 biopsycho-social-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-703. Social Work Practice with Individuals and Families **Credit 3 (3-0)**
The specific focus of this course is direct practice with individuals and families. Students will learn interviewing and interpersonal helping skills; how to conduct psychosocial assessments and select appropriate intervention approaches based on client goals, problems, and strengths; and how to implement those interventions. Students are also introduced to the concept of evaluation of direct practice in relation to each practice theory they study. Effective oral and written communication and technology skills necessary for professional practice are stressed.

SOWK-704. Social Work with Groups **Credit 3 (3-0)**
The purpose of this course is to prepare students for entry into field instruction. In this course students will begin to develop the knowledge and skills necessary for advanced generalist practice with groups. Students will learn four basic group work models. Special attention is devoted to developing relationships and working effectively at the mezzo level with individuals of diverse cultural and racial backgrounds along with populations at risk. Students will learn how to effectively set-up, plan, facilitate and evaluate groups across social work settings. This course will provide hands on learning through a small group experience as part of each class.

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 Education I **Credit 5 (5-0)**
This course is the first field experience. The purpose of this course is to provide an opportunity for students to synthesize theoretical knowledge together with application in a variety of agency settings and among diverse client systems. Students are expected to apply theories and concepts from previous and current courses to enact the role of a professional social work practitioner with the client systems of various field agency experiences.

SOWK-710. Social Work with Families and Youth at Risk 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 and Youth at Risk 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 and Mental Health I **Credit 3 (3-0)**
This course is the first of two courses in the Health and Mental Health area of practice.This first course focuses on health and mental health disorders across the life span as well as an exploration of the complex interrelationships between health and mental health care practices, social work values, and ethical dilemmas. Students will integrate knowledge and skills to engage in advanced generalist social work practice in health and mental health settings.This course will address policy and procedural issues unique to the administration and program services within health and mental health settings.

SOWK-713. Social Work in Health and Mental Health II **Credit 3 (3-0)**
This is the second course in the Health and Mental Health area of practice. This course continues to focus on health and mental health disorders across the life span as well as an examination of effective direct and indirect practice interventions. Material on models for working with clients, family members, and caregivers, will be covered. Attention is given to understanding differential patterns of health care service utilization and delivery based on demographic characteristics such as age, race, ethnicity, gender, and sexual orientation. Current policy initiatives and social work roles within health and mental health settings are examined.

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.

SOWK-719. Field Seminar I **Credit 1 (1-0)**
This course assists students in the integration of theory and classroom knowledge into their field practice.

SOWK-721. Field Seminar II **Credit 1 (1-0)**
This course is a continuation of Field Seminar I, assisting students to integrate theory and classroom knowledge into their advanced generalist agency field practice.

SOWK-722. Field Education II **Credit 5 (5-0)**
The second year field experience is a culmination of the academic preparation for Social Work practice. As advanced generalist, 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.

SOWK-723. Field Education III **Credit 5 (5-0)**
This course is a continuation of the second year advanced generalist field experience. Students apply theories and concepts to the role of a professional social work practitioner within a field agency.

SOWK-725. Field Seminar III **Credit 1(1-0)**
This course is a continuation of Field Seminar II. It culminates the student's advanced generalist agency field practice through the completion of capstones and other assignments.

SOWK-731. Social Work with Individuals and Families: Theory, Behavior, and Practice **Credit 3 (3-0)**
This course covers personality and family theories and their application to practice with individuals and families.

SOWK-732. Social Work with Groups, Communities, and Organizations **Credit 3 (3-0)**
This course addresses the practice of social work with groups, communities, and organizations through the examination and application of an advanced generalist framework.

SOWK-733. 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 social work or social welfare through supervised study, outside the classroom setting. The problem must be selected from the scholarly literature of social work or social welfare. The work of the course must be submitted in the form of a written report.

Department of Sociology and Social Work
Dr. Robert Davis, 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-674	Evaluation of Social Programs
SOCI-701	Seminar in Cultural Factors in Communication

Graduate Faculty

Department: **Sociology & Social Work /Joint Master of Social Work**
Chair: **Dr. Robert Davis**

Fasihuddin Ahmed, B.A., Forman Christian College; M.A., University of the Punjab; Ph.D., University of Chicago; Professor

Arnold Barnes,; B.A., University of Maryland Baltimore County; M.S.W., University of Maryland at Baltimore; Ph.D., Washington University; Associate Professor

Glenna Barnes, B.S.N., Boston University; M.S.W., University of Maryland at Baltimore; Ph.D., Indiana University; Assistant Professor

Stanley F. Battle, B.A., Springfield College; M.S.W., University of Connecticut; M.P.H., University of Pittsburgh; Ph.D., University of Pittsburgh; Professor

Phillip Carey, B.S., Oklahoma State University; M.S., Oklahoma State University; Ph.D.., Oklahoma State University; Professor.

Yoko S. Crume, B.A., International Christian University; M.S., University of Cincinnati; M.S.W., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill; Assistant Professor

Terrolyn P. Carter, B.S., Xavier University of Louisiana; M.S., University of Missouri-Columbia; Ph.D., University of Missouri-Columbia; Assistant Professor

Sharon W. Cook, B.A., North Carolina Central University; M.S.W., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Greensboro; Assistant Professor

Robert Davis, B.A., Southern University; M.A., Atlanta University; Ph.D., Washington State University; Post-Doctoral, University of Wisconsin at Madison; Professor

William Hardy, B.S.W., North Carolina A & T State University; M.S.W., University of South Carolina at Columbia; Lecturer

Andrea N. Johnson, B.A., North Carolina A & T State University; M.S., North Carolina State University; Ph.D., North Carolina A & T State University; Lecturer

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Mary T. Lewis, B.A., Davis and Elkins College; M.S.W., University of Connecticut; Ph.D., Saybrook Graduate School and Research Center; Assistant Professor

Wayne Moore, B.S., East Carolina University; M.S.W., Ohio State University; Ph.D., University of South Carolina at Columbia; Professor

Maura B. Nsonwu, B.S.W., University of North Carolina at Greensboro; M.S.W., University of South Carolina at Columbia; Ph.D., University of North Carolina at Greensboro; Adjunct Assistant Professor

Elizabeth D. Watson, B.A., Columbia Union College; M.S.W., Howard University; Ph.D., Andrews University; Associate Professor

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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POLICY GOVERNING PROGRAMS AND COURSE OFFERINGS

All provisions, regulations, degree programs, course listings, etc., in effect when this catalogue went to press are subject to revision by the appropriate governing bodies of North Carolina Agricultural and Technical State University. Such changes will not affect the graduation requirements of students who enroll under the provisions of the catalogue.

Piedmont Independent College Association of North Carolina

The Piedmont Independent College Association of North Carolina is an organization comprised of North Carolina Agricultural and Technical State University, The University of North Carolina at Greensboro, High Point College, Greensboro College, Bennett College, Guilford College, and Guilford Technical Community College. The organization promotes inter-institutional cooperation and cooperative educational activities among the seven institutions. Agreements provide the opportunity for any student to enroll at another institution for a course or courses not offered on one's home campus.

RESOURCES AND STUDENT SERVICES

THE DIVISION OF UNIVERSITY ADVANCEMENT

The Division of University Advancement encompasses the program areas of Development, University Relations, Alumni Affairs, Advancement Services, the University Foundation and other administrative functions related to overall institutional advancement and marketing. In addition, the office aids in conducting the affairs of the North Carolina A&T University Foundation, Inc., which has been established to assist in soliciting gifts, grants and contributions from public and private sources for such worthy purposes as student scholarships, faculty development, library resources, specialized equipment and cultural and public service programs. The mission of the Division of University Advancement is to support the university through the enhancement and management of private resources by expanding opportunities for engagement, increasing the division's resources, strengthening the university's brand and improving communications. The Advancement office is located in Suite 400 of the Dowdy Administration Building. The Office of Alumni Affairs and the NC A&T University Foundation are located in the Alumni-Foundation Event Center at 200 N. Benbow Street. The University Relations department is located in the Garret House on Nocho Street next to Murphy Hall

Division of Research & Economic Development

The Division of Research and Economic Development's (DORED) mission is to increase research through enhanced faculty participation and to aid in transforming and transitioning more of the University's research into new products and jobs for economic development. True to that mission, the DORED works aggressively to expand the University's relationship among research sponsors, develop relationships with the larger community and enhance the University's competitiveness in the mainstream.

Specifically, the Division of Research & Economic Development administers and manages research and sponsored programs as well as outreach, technology transfer and commercialization for the University. Headed by the Vice Chancellor for Research & Economic Development, the division is made up of the Vice Chancellor's management team, the Office of Research Services, the Office of Sponsored Programs, the Office of Compliance, and the Office of Outreach and Technology Transfer.

FOOD SERVICE

Aggie Dining provides an exciting and innovative dining services program for the entire North Carolina A&T State University community. You will find great food, honest values and a comfortable atmosphere in which to enjoy it all. You have a variety of restaurants to choose from, all conveniently located within walking distance of on-campus housing, labs, classrooms and many off-campus apartments. The University provides food services for students at a reasonable cost. Students who live in the residence halls are required to purchase a meal plan; several options are available (minimum 10/week). Students who live off campus may also purchase meals or a meal plan.

HOUSING AND RESIDENCE LIFE

http://www.ncat.edu/~housing/

Administering to the physical environmental needs of thirteen (13) residential facilities, Housing and Residence Life strives to achieve comfortable, clean and safe living and learning environments for over 3,800 residential students. The campus living experience is more than a room to sleep – it is being a part of a dynamic campus community. Housing and Residence Life works diligently to address and meet residential student needs through caring and student-focused processes. The Department's support of student success is operationalized through in-hall programming and academic tutoring opportunities, mentoring relationships, along with the establishment of living/learning communities that foster critical thinking, problem-solving, and community and civic responsibility perspectives and understanding.

OFFICE OF CAREER SERVICES

http://www.careerserv.ncat.edu

The primary mission of the Office of Career Services (OCS) is to provide centralized, comprehensive and progressive interdisciplinary programs, services and resources to prepare A&T students for the achievement of successful personal and professional career development to meet the needs of a global society. Continuous career development assistance is also available to alumni of the University. Individuals who are formally enrolled in a degree-granting program at North Carolina Agricultural and Technical State University or who are A&T graduates are eligible to use the facilities, programs and services of the Office of Career Services. These services include the following:

Student Employment Programs

Cooperative Education Program (Co-op **is an optional, counseling-centered program that offers students the opportunity to alternate periods of academic study with periods of work closely related to their major field of study. The combination of academic study and work produces an overall learning experience that gives greater meaning to students' studies and more direction to career development.**

Any undergraduate or graduate student enrolled in a degree-granting program at North Carolina A&T State University (NC A&T) can participate. Participants must establish and maintain at least a 2.0 overall grade point average. Freshmen must complete their first academic year prior to the first work assignment and transfer students must complete one semester.

Students must be registered with the Office of Career Services (OCS).

Typically, a co-op assignment lasts a full fall or spring semester (12-16 weeks). Usually an employer will require at least two sessions, which can include one summer session.

While on work assignment, students are considered in good standing with the University; however, they may not be enrolled in courses unless they are applying for academic credit. Participants are expected to work two to three times before they graduate and at least one work period should be scheduled other than a summer session. Students who co-op during the fall or spring semester are assessed a $30 administrative fee by the University, which is due and payable during the semester of work. In addition, students desiring academic credit for assignments must register through their respective academic departments and pay the required tuition. Please contact the Assistant Director of Career Services for Experiential Learning with inquiries and questions.

Part-time employment **opportunities are posted as received in the Office of Career Services and on the OCS website. These jobs provide local and regional opportunities for students who are interested in supplemental income during the school year. Students are responsible for making the appropriate contacts and following through with prospective employers.**

Summer internships Summer internships offer students the opportunity to gain work experience in industry and government. These positions are offered during the summer and are highly competitive. For companies that do not actively interview during the recruiting season, applications and announcements are available in the Office and online. Opportunities are also available for participation in The Institute of Government and the North Carolina State Government Internship Program. INROADS actively recruits at the University. Interested students must meet the criteria and qualifications established by INROADS and the sponsoring employers.

Permanent Career Options

On-campus Recruitment **is available to degree-seeking students and alumni of North Carolina Agricultural and Technical State University. Opportunities are available in the local, state, national and international arenas. North Carolina Agricultural and Technical State University observes October 1 though November 30 as the official on-campus recruiting period for the fall semester. During the spring semester, interviews can be scheduled between late January and mid-April. There is no recruiting during the months of May through September nor during the month of December. The Office of Career Services on-campus interview information is available online. Students/Alumni must be registered with the Office of Career Services in order to interview.**
Alumni **are eligible to participate to use the facilities of the Office but must register online. The present graduating class has priority on all interview schedules.**
AggieLink, the OCS job listing service, exposes students and alumni to thousands of job opportunities available nationwide. Job listings are available online.

Awareness Programs/Career Fairs

In addition to the recruitment function, the Office of Career Services is actively involved in exposing A&T students to career opportunities and professionals in various career fields. This is accomplished through annual career awareness programs, workshops and information sessions. The annual programs include the following:
Career Awareness Fair **is held in September to give students an opportunity to network with more than 200 companies/agencies about full-time, co-op and summer internship opportunities and learn what skill sets are in demand.**
Health Career Fair **provides an opportunity for students to increase their awareness of the types and availability of careers in the health care field.**
Graduate & Professional School Day **is usually held in the fall semester and allows students to broaden their knowledge of postgraduate programs and learn about application information, scholarship and financial assistance offered at various graduate, law and medical schools. This career day is attended by graduate and professional schools from across the United States.**
*Spring Career Fair***, held during the spring semester, is open to all majors and enables students to talk with employers about full-time, co-op and summer opportunities.**
Education/Arts & Sciences Expo (EASE) is held during the spring semester and is specifically designed to assist education and arts and sciences majors.

Additional Services

The Office of Career Services hosts *workshops, seminars, counseling sessions, classroom presentations, and information sessions* on a regular basis. The centralized, comprehensive and progressive programs, services and resources provided by the Office are tailored to be a gateway for the enhancement of the skills necessary to keep the A&T Aggie competitive in the work-place. All students are encouraged to register with the OCS and actively take advantage of the services offered. OCS is available 24/7 to students, employers, faculty, and online information for parents either by visiting Suite 101 Murphy Hall or online at www.careerserv.ncat.edu. The website contains links, which includes information on summer internships and co-ops, *What Can I Do With My Major?*, on-campus interviewing and information sessions. The Office brings over 700 employers to campus and provides more than 15,000 position announcements yearly.

STUDENT ORGANIZATIONS AND ACTIVITIES

http://www.ncat/edu/~studev/

The University provides a well-balanced program of activities for moral, spiritual, cultural and physical development of its 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.

The Council of Presidents (COP) of North Carolina A&T State University serves as the governing body of student organizations. The Office of Student Development issues Registration Kits to organization leaders at the meeting of the Council of Presidents, on the first Tuesday after classes begin in the fall of each year. After student organization leaders have registered their organizations, they are then eligible to use all campus facilities at no cost to the organization.

The Assistant Vice Chancellor for Student Development Office provides interpretation of the University's policies as they relate to organizational community. All events must reflect the interest of the University community. Permission to use University facilities may be denied or revoked for non-compliance with the Guidelines and Implementing Procedures for the use of University facilities.

Approximately one hundred fifty (150) organizations are registered and approved on the campus. Categorically, the organizations include, National Honor Societies, Departmental Clubs, Gospel Choir, Social Clubs, Student Military Organizations, Fraternities, Sororities, Hometown Clubs, Residence Councils, the Student Union Advisory Board, Class Organizations and Drama Societies. Other University sponsored organizations include the University Choir, University Band and the Student Government Association.

Descriptions and membership requirements for all University recognized and registered organizations are printed in the *Student Organizations Handbook*. The Office of Student Development publishes a listing of student organizations, their purposes, objectives, chief officers, and advisors annually. This document is available upon request, the office is located in Murphy Hall Room, Suite 104. The phone number is 336-334-7792 or by e-mail at osd@ncat.edu.

MEMORIAL STUDENT UNION

http://www.ncat.edu/~union

The Memorial Union functions as the "Community Center" for the University and its constituency by providing a variety 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, Aggie Escort Shuttle Service, The Yearbook Office, computer lab, , University Events Center, Aggie OneCard, Honda Campus All-Stars 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 (Aggie Underground), 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.

VETERAN AFFAIRS

http://www.ncat.edu/~ovdss/

North Carolina Agricultural and Technical State University is an approved site for veterans and veteran dependents wishing to attend and receive educational benefits.

Admission to the University is done 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 Office of Veterans Affairs located in Suite 01, Murphy Hall is established to assist veterans and veteran dependents with enrollment and adjustment to college life. Upon enrolling at the University, the veteran or eligible person should report to the Office of Veterans Affairs so that verification of enrollment can be sent to the Veterans Administration. If a Certificate of Eligibility has not been issued, the veterans or the eligible person should see the University Certifying Official.

The Office also provides counseling and tutorial services as necessary.

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 and confidential. 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.

MULTICULTURAL STUDENT CENTER

http://www.ncat.edu/~multicultural

The Multicultural Student Center (MSC) is an integral part of the University. Located in 204 Murphy Hall, the Office provides programs and services that support the academic mission of the University by enhancing the educational, personal, cultural and social development of our diverse student population. The MSC exists to promote understanding and appreciation of diversity on our campus. From it's Latina director, Dr. Maria Teresa Palmer, to its multiethnic student advisory council, it helps students of all ethnicities and diverse backgrounds to come together, learn from each other and enrich our whole community. Among the student organizations housed at the MSC are the *Society of Hispanic Professional Engineers (SHPE), Acceptance Without Exception Gay-Straight Alliance,* and the new *Aggie Soccer Club*.

The Multicultural Student Center offers leadership opportunities, social and service activities, often in cooperation with other campus organizations. Numerous programs and services are available at the MSC to address the academic, cultural and personal needs of our diverse population and to ensure that each student in the NC A&T community receives the best education possible. Supporting the Multicultural Student Center is one way in which the University has dedicated itself to building bridges of knowledge, cooperation and understanding between persons of all sexual orientations and differing religious, ethnic and social backgrounds. The Center is open from 8am – 5pm daily and is staffed by the Director and the Center Manager.

Bookstore

Located on the corner of Laurel and Bluford Streets in Brown Hall, the University Bookstore offers a wide variety of services to the university community. The newest addition to its offerings is the ability to place orders online. Place your order today at www.ncatbookstore.com! Freshmen desiring to have their books ready at the beginning of each semester should use the bookstore's Textbook Pre-Pack Service offered during orientation. A variety of computer hardware and software supplies are available from Dell and Apple at educational prices. The Bookstore offers snacks, school supplies, clothing, cards, notebooks, and calculators! Other services include expanded store hours to satisfy the Aggie in you during home football games, a photocopying machine, fax services and free notary service. For added convenience, a Wachovia teller machine is located in the same building. For more information on the Bookstore's offerings, please call 336-334-7593 or visit our website at www.ncatbookstore.com.

STUDENT DEVELOPMENT SERVICES

http://www.ncat.edu/~studev/

The purpose of the Office of Student Development (OSD) is to promote an environment at North Carolina A&T that provides for the overall growth and development of students. OSD is charged with the implementation of orientation and transitional programs for students and their families. Through social, cultural, leadership, educational and service experiences, students are encouraged to form a community that includes those from every academic division and program, and to become active participants in university life.

Our mission is to foster **student** growth and **development** and facilitate **student** success and retention.

OSD promotes purposeful involvement of students by:

- Fostering an atmosphere in which students share ideas freely and work collaboratively.
- Providing a safe and inclusive environment.
- Offering opportunities to develop leadership skills.
- Supporting the growth of student organizations.
- To provide opportunities for students to interface with city, state and national government officials.
- To promote student organizations as viable resources for the University and Greensboro Communities.

Leadership Development

As a compliment to the established mission of the Division of Student Affairs, this unit promotes leadership experiences and processes by which individuals and organizations are empowered to work together synergistically toward a common goal or vision that will create change, transform institutions and thus improve their quality of life.

The primary goals of the unit include:

- Providing opportunities for students to explore and address issues that affect them and their environments through Social consciousness, Leadership effectiveness, Academic awareness, as well as Membership Development.
- Coordinating and facilitating workshops, seminars, programs and conferences geared towards personal and professional growth, human relations, and civility.
- Utilizing the entire Aggie community, to develop our 5 C's of Leadership: Character, Congruence, Commitment, Collaboration, and Citizenship, in the student body.
- Creating a support mechanism, central location for resources and information, and development opportunities for the various constituent groups and programs associated with leadership, such as the Council of President, Organization Advisors, Leadership 101 series, and the Aggie Leadership Certification Program.
- As an integral component of the Office of Student Development, fostering an environment where students share ideas freely and work collaboratively with faculty, staff and other students; while promoting them as ambassadors to the global community.

Civic and Service Education (CASE)

To further the mission of North Carolina Agricultural and Technical State University, The Office of Student Development, through the Civic and Service Education Program (CASE) has dedicated itself to promote a just and humane society through community service and civic engagement. The program is to promote service-learning as an integral aspect of education and to foster university engagement with the larger community. To provide and promote quality service-learning that fosters student learning and development toward outcomes including Civic engagement, collaborative leadership and appreciation of diversity. The program will foster authentic partnerships that support and enhance the University's mission as an engaged citizen in the greater community. To promote the Institutionalization and sustainability of service-learning as an integral aspect of education and provide a variety of forms of service-learning at North Carolina Agricultural and Technical State University.

The general goal of the Civic and Service Education (CASE) Program is to integrate the pedagogy of service learning into North Carolina Agricultural and Technical State University's fundamental courses of University Studies by developing an infrastructure on the foundation of existing interdisciplinary initiatives in community development. This will facilitate the institutionalization of service-learning at North Carolina Agricultural and Technical State University and augment the University's role in meeting community-defined need through university-community partnerships.

COUNSELING SERVICES

http://www.ncat.edu/~counsel

Counseling Services offers a variety of services to help all currently enrolled North Carolina A&T State University students address challenges and difficulties they may face. Our services are designed to help students understand themselves better, create and maintain healthy relationships, improve their academic performance and make satisfying career and life choices. We are dedicated to helping our students by providing brief counseling from a wide spectrum of services. Those include individual and group counseling, outreach and consultation, training and supervision, teaching, psychological testing, and research. If more intensive or specialized care is needed, we will assist with making referrals to healthcare providers in the community. All counseling is voluntary, free of charge, private, and confidential.

The following services are available through the Counseling Services:

1. Personal counseling in individual and group sessions
2. Academic and career/vocational counseling and assessments.
3. Outreach counseling programs and activities, Life Skills and Personal Growth Programs
4. Graduate student internship training laboratory for psychology, social work, and counseling.
5. Individual test administration and interpretation covering the areas of intelligence, aptitude, personality, interest, and achievement, as well as other areas required by special needs.
6. College Level Examination Program (CLEP) for course credit by examination, National League of Nursing (NLN), Psychological Assessments for Learning Disabilities (LD) and Attention-Deficit / Hyperactivity Disorder (ADHD), and Department Screening Assessments.
7. Information is provided for: Praxis Teachers' Examination, Graduate Management Admissions Test (GMAT), Graduate Record Exam (GRE), and Medical College Admissions Test (MCAT).
8. Exit interviews for students withdrawing from the University for psychological or medical reasons.
9. Official University Excuses
10. Referrals (University and Community Resources).

UNIVERSITY POLICIES ON ALCOHOL

All usages of alcoholic beverages will conform to existing state, local and University laws and policies:

1. There will be no consumption of alcoholic beverages in a motor vehicle while on University property or on University streets.
2. There will be no public display of alcoholic beverages.
3. Consumption of alcoholic beverages is restricted to students' rooms in residence halls only for those students of legal age.
4. Anyone who drink alcoholic beverages will be held accountable for their behavior. Irresponsible drinking will not be accepted as an excuse for irresponsible behavior. Such behavior will result in judicial action and/or notification to parent or guardian.

UNIVERSITY DRUG POLICY

North Carolina Agricultural and Technical State University strives to provide an educational environment that enhances and supports the intellectual process. The academic communities, including students, faculty and staff have the collective responsibility to ensure that this environment is conducive to healthy intellectual growth. The illegal use of harmful and addictive chemical substances poses a threat to the educational environment. Each member of the University family is reminded that in addition to being subject to University regulations and sanctions regarding illegal drugs, they are also subject to the laws of the State and of the nation. This policy has been developed in accord with *The University of North Carolina Policy on Illegal Drugs*, adopted by the Board of Governors January 15, 1988. It establishes the framework for programs designed to educate the campus community on the harmful effects of illegal substances and to assist afflicted persons in their efforts to become rehabilitated. It also provides guidance for punishing violators.

ZERO TOLERANCE FOR DRUGS POLICY

1. Any student who is charged, <u>as a first offense</u>, with the use and/or is in possession of marijuana (or any other illegal drug) on campus will <u>immediately</u> lose campus housing privileges and will be required to appear before a campus judicial board.
2. A second offense will result in <u>immediate</u> suspension from the University.
3. Felony possession of marijuana (or any other illegal drug) will result in <u>immediate suspension</u> from the University.
4. Any student convicted of possession or sale of a controlled substance under federal or state law will lose eligibility for Student Financial Aid assistance.

Educational and Rehabilitation Programs

The University shall establish and maintain a program of education designed to help all members of the University community avoid involvement with illegal drugs. This program shall emphasize these subjects:

1. The incompatibility of the use or sale of illegal drugs with the goals of the University.
2. The legal consequences of involvement with illegal drugs.
3. The medical implications of the use of illegal drugs.
4. The ways in which illegal drugs jeopardize an individual's present accomplishments and future opportunities.

The University shall provide information about drug counseling and rehabilitative services (campus-based or community-based) available to students and employees.

Persons who voluntarily avail themselves of these University services or programs are assured that applicable professional standards of confidentiality will be observed.

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 taking 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 Agricultural and Technical State University to insure 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 are, as more specifically set forth later in this policy, subject to specific sanctions and penalties.

All members of the University family are reminded that in addition to being subject to University regulations and sanctions regarding illegal drugs and the abuse of alcohol, they are 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 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 the 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. Continuous monthly outreach programs in each residence hall.

Although directed primarily to the student population, the above noted educational programs shall also 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:

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 continuous use.

While these health risks are broad in range, persons consuming illicit drugs and alcohol will exemplify 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, it is the University's intent 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 assessments 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 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 discharges 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 Agricultural and Technical State University that the consumption of alcohol sufficient to interfere with or prohibit the otherwise normal execution of job responsibilities is improper and subjects the employee to appropriate disciplinary procedures. It is also the policy of North Carolina Agricultural and Technical State University that alcoholic beverages not sold on campus. Employees violating the above noted policies are subject to appropriate disciplinary procedures, which 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 the alcoholic beverages noted above. 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 2l 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 and 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 the discretion of the court.

II. By Person over Lawful Age - Any person who is over the lawful age to purchase and 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.

1. 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 age
   d. Abuses of alcoholic beverages

2. There will be no consumption of alcoholic beverages in a motor vehicle while on University property or on University streets.
3. Personal consumption of alcoholic beverages is restricted to students' rooms in residence halls, if they are of legal drinking age.
4. The possession or consumption of alcoholic beverages shall not be permitted in public places, such as lounges, game rooms, study rooms, kitchens, laundries or patios.
5. There will be no public display of alcoholic beverages.
6. 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. The distribution to all enrolled students will occur as a part of the registration process. The University Personnel Office will administer the distribution to University employees.

The Chancellor of the University shall insure on a biennial basis that this policy is reviewed for purposes of assessing its effectiveness, 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 Agricultural and Technical State University recognizes that the use of illegal drugs and the abuse of alcohol are a national problem 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 behaviors and as a 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 effective 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*. All affected individuals can be assured that applicable professional standards of confidentiality will be maintained at all times.

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GRADUATE CATALOG OF
NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY
SCHOOL OF GRADUATE STUDIES
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