North Carolina State University

Graduate Catalog

The Graduate Catalog contains Graduate School requirements and pertinent information for individual graduate programs, a current list of graduate faculty, and a selection of other resources for new students. The Catalog is informational only and is subject to change. Official policies and procedures are in the Graduate School Administrative Handbook and on the NC State Policies, Rules and Regulations website.

This catalog is intended for informational purposes only, and it is subject to change.
Please see the online Administrative Handbook at http://www.fis.ncsu.edu/grad_publicns/handbook/
for changes in policies, rules, regulations, and procedures.

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North Carolina State University

Graduate Catalog

North Carolina State University

North Carolina State University (NC State) is a national center for research, teaching and extension, and its graduate education has stood for quality for more than a century. As a land-grant state university, it shares the distinctive characteristics of these institutions nationally -- broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

NC State is one of 16 constituent institutions of the multi-campus University of North Carolina system. 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."

NC State is a member of the National Association of State Universities and Land-Grant Colleges. It is also a member of the American Council on Education, the College Entrance Examination Board, the Council of Graduate Schools, the National Commission on Accrediting and the Southern Association of Colleges and Schools.

NC State University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award associate's, baccalaureate, Master's, and doctoral 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 NC State University.

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North Carolina State University

Graduate Catalog

The Graduate School

Graduate instruction was first offered at North Carolina State University in 1893, and the first doctoral degree was conferred in 1926. In the ensuing years, the Graduate School has grown steadily and now provides instruction and facilities for advanced study and research in the fields of agriculture and life sciences, design, education, engineering, natural resources, humanities and social sciences, management, physical and mathematical sciences, textiles and veterinary medicine.

The Graduate School is currently composed of more than 2,400 graduate faculty members. Educated at major universities throughout the world and established both in advanced teaching and research, these scholars guide the University's more than 7,000 Master's and doctoral students from all areas of the U.S. and many other countries. The faculty and students have available exceptional facilities, including libraries, laboratories, modern equipment and special research areas.

Additionally, a cooperative agreement exists among the Graduate Schools of the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro, Duke University, and North Carolina State University which increases the educational and research possibilities associated with each institution.

North Carolina State University

Graduate Catalog

Application and Admissions

The criteria used for admissions decisions vary according to programs and schools/colleges, reflect an evaluation of the applicant's potential for graduate work, and consider the ability of a program to accommodate additional students. Commonly, departmental admissions committees consider requests for admission and forward their recommendations to the Graduate School. However, Graduate School regulations govern the criteria for the classification of graduate student status.

APPLICATIONS

All applicants must submit the online NC State University Graduate School Application Form. Application is made for a specific degree program and date of enrollment (see Admissions).

Applications for admission require the following:

- Non-refundable application processing fee of $65.00 (US) for U.S. citizens and Permanent Residents or $75.00 (US) for Non-Resident Aliens (Internationals);
- One official transcript from all colleges and universities previously attended; (**NOTE:** Applicants currently attending, or who have previously attended NC State, are not required to provide an NC State transcript.)
- Three recommendations from people who know the prospective student's academic record and potential for graduate study;
- On-line North Carolina Residency Form if claiming NC residence for tuition purposes;
- A list of courses in progress if enrolled as a Post-Baccalaureate Studies (PBS) student at NC State;
- GRE or other standardized test scores, statements of purpose, portfolios or other work samples, depending on requirements of particular program; and
- TOEFL scores, where applicable.

English Proficiency Requirements for International Students

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 NC State. This requirement can be met for most applicants in one of the following ways; however, some programs may require additional evidence of English proficiency:

- Provide Test of English as a Foreign Language (TOEFL) with a total score of at least 80 on the Internet-based Test (iBT). Minimum test scores for each section:

Listening	15 points
Reading	20 points
Writing	20 points
Speaking	20 points - for admission to the Graduate School
	23 points - for TA appointment where TA has direct verbal interactions with students
	26 points - for TA appointment where TA presents lectures in the class or laboratory

- The maximum total score for the iBT is 120 with each section worth 30 points.
- be a citizen of a country where English is an official language and the language of instruction in higher education; or
- have successfully completed at least one year of full-time study in a degree program at a four-year US College or university.

NOTE: The current computer- and paper-based versions of the TOEFL test will be given until the iBT version is implemented in a particular location.

Admission

The procedures followed in evaluating an applicant's potential for success in graduate work and the criteria used for admissions decisions vary according to programs and colleges 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. Most programs consider applications as they arrive, while others accumulate applications

and make recommendations on admission at certain times during the year. Generally, requests for admission are considered by program admissions committees that forward the program recommendations to the Dean of the Graduate School.

Students are admitted to full or provisional status in a specific degree program. Admission is granted for a specific semester or summer term. Any change in the admission date must be requested in writing and approved by the program and Graduate School. Once the requirements for that degree program have been completed, no further registration as a graduate student will be permitted unless admission to a new graduate classification has been formally approved. Students with special objectives may request admission in the "Graduate-Unclassified Status" or register in the "Post-Baccalaureate Studies" program through the Division of Lifelong Education.

Immunization and Medical History

All graduate students admitted to a degree program are required by State law to submit a report of medical history and immunization documentation prior to initial registration. This report must document immunization against tetanus/diphtheria, measles, German measles, polio, and for international students, show results of a tuberculin skin test. Graduate students who have recently completed their undergraduate work at NC State must update their medical history. Student Health Services must receive the required reports at least 30 days before registration. If the student does not meet this requirement, dismissal from school is mandatory under the law.

Transcript Requirements

The University requires that official copies of transcripts of all prior course work be on file in the student's permanent record at NC State. Students are required to provide the Graduate School with official copies of their latest transcript(s) from all universities attended (official translation required for non-English transcripts), including statements of all degrees awarded, no later than the last day of classes of the first semester they are enrolled.

ADMISSION TO DEGREE PROGRAMS

Full Graduate Status

To be considered for admission in full graduate standing, an applicant must have a Bachelor's degree from an accredited college or university as determined by a regional or general accrediting agency and must have at least a "B" (3.00/4.00) average in the undergraduate major or in the latest graduate degree program.

Exceptions on standard accreditation may be granted for applications with international degrees, including applicants with three-year degrees from institutions in Europe participating in the Bologna Process.

Provisional Status

Students with Bachelor's degrees from accredited institutions whose scholastic records are below the standards for admission to full graduate standing may be admitted provisionally when unavoidable, extenuating circumstances affected their undergraduate averages or when progressive improvement in their undergraduate work warrants provisional admission. Students admitted provisionally under these circumstances can attain full graduate standing after completion of nine or more graduate credit hours with a minimum GPA of 3.00. Courses taken for S/U grade cannot be used as part of the minimum.

Provisional admission may be granted to applicants with Bachelor's degrees from accredited institutions who lack undergraduate work considered essential for graduate study in a major field. Applicants with Bachelor's degrees from non-accredited institutions may be granted provisional admission when their academic records warrant this status.

Full graduate standing is granted when the deficiencies responsible for the provisional status are corrected through additional course work (without graduate credit), provided the student has maintained a satisfactory academic record (3.00 GPA) on all course work taken in a graduate classification. A change from provisional status to full graduate standing is effected only upon the recommendation of the department in which the student is seeking the degree.

A graduate student is not eligible for appointment to an assistantship or fellowship while on provisional status.

Graduate-Unclassified Status

The Graduate-Unclassified status is a temporary classification and students admitted to this status are not candidates for degrees. They may take courses for graduate credit but may not apply more than 12 credits earned while in this status to any program leading to an advanced degree at this institution. Unclassified graduate students are expected to meet the same admissions requirements that apply to graduate students in full standing. Any individual having an interest in applying for admission as a Graduate-Unclassified Student should correspond with the Graduate Dean describing his or her particular interests and objectives prior to making application.

Admission for International Students

International graduate students are admitted to either full-time study in a specific graduate program or into the Graduate-Unclassified category as an international visitor. In addition to admission requirements listed elsewhere for graduate admission, applicants who are not U.S. citizens must complete and submit a Visa Clearance Form and/or a Certificate of Financial Responsibility before a final admission decision can be made. Criteria for international visitors are as follows:

1. International student visitors must state their educational objectives at NC State and the time expected to accomplish those objectives (normally one semester or one academic year). The educational objective may not be to seek a graduate degree at NC State.

2. They are expected to meet the same minimum academic admission requirements that apply to graduate students in full standing.
3. They are expected to meet the same TOEFL requirements that apply to international students who are admitted to Master's and doctoral programs if they plan to take courses. If they plan to register for research only, they are not required to take the TOEFL.
4. They must be recommended by the DGP of the program in which they plan to take courses or do research. Special admission status may apply for a period not to exceed one year.
5. They may hold a research assistantship but may not hold a teaching assistantship (provided their nonimmigrant status allows on-campus employment).
6. They will not be eligible for the Graduate Student Support Plan.
7. Those in F-1 or J-1 status must maintain full-time enrollment and all other requirements based on their particular nonimmigrant status.

Post-Baccalaureate Studies (PBS)

The Post-Baccalaureate Studies (PBS) classification is designed for U. S. citizens or permanent residents who wish to undertake academic work beyond the Bachelor's degree but who are not currently admitted to a degree program. This classification is not open to international students with the exception of the spouse of a regularly enrolled NC State student. In special cases where students are sponsored by an agency of the U.S. government for specialized, non-degree study, approval may be given by the Graduate School for registration in the PBS classification. The following rules apply to students who wish to register for PBS.

Please note that the following are university minimum requirements. Some departments may have more restrictive requirements.

1. All must have Bachelor's degrees from accredited institutions of higher education. Registration is through the Division of Continuing Studies.
2. All classes taken for credit by PBS students will be graded in the usual manner that applies for the particular course (A+ through F or S/U). All courses taken at NC State will appear on the student's transcript.
3. If the student is admitted as a graduate student, a maximum of twelve (12) hours may apply toward the minimum university requirement of the Master's degree (i.e., 30 credit hours) for which the student is enrolled, including hours approved for graduate credit while classified as a senior or unclassified graduate. The first twelve (12) hours of course work taken at the graduate level in the PBS category will be accepted toward degree requirements unless a request for some other combination of twelve (12) hours is made by the student's advisory committee and approved by the Graduate Dean. PBS credits cannot be transferred into a doctoral program.
4. If a student's graduate degree is terminated, he/she cannot use courses taken in PBS status after termination for credit toward the same graduate degree program.
5. The grade point average (GPA) of a graduate student who has credits in the PBS category will be based on all courses taken at the 400-800 level. However, no course taken six (6) years prior to graduation from a program can be used to meet the requirements for a later graduate degree at NC State.
6. Registration is limited to a maximum of two courses per semester. Individuals who are employed full-time should limit their PBS registrations to one course per semester.
7. The PBS classification carries with it no implication that the student will be admitted to the Graduate School in any degree classification.
8. All course work accepted for degree credit must be approved by the student's advisory committee as being germane to the program. Requests for degree credit for courses completed in the PBS classification are considered after admission to a graduate degree program when the student's Plan of Graduate Work is filed with the Graduate School.
9. PBS students are expected to familiarize themselves with Graduate School and departmental policies and to seek further advice or clarification as needed.

Distance Education

Distance learning offers you the opportunity to participate in a different learning environment by allowing students to have instruction off campus. Valuable learning time is gained by providing an educational environment that increases accessibility and flexibility for learners.

NC State's distance learning includes some Internet-based courses, but also offers study through the use of videotape, cable TV, interactive TV, satellite, and independent study programs. In addition, Distance Education courses require more writing than in a traditional classroom setting via electronic participation. On-line discussions and e-mail communications allow regular involvement by all students, not just a few.

Distance Education Programs

NC State offers credit courses on a vast number of subjects, with more than 100 individual distance education courses to choose from in the humanities, engineering, social sciences, textiles, physical sciences, and more.

Degree programs require admission to the university. Since each program sets its own admission requirements, students should contact the program of their interest for details. A full listing of programs is available on the Distance Education website.

Professional development courses are also available through Distance Education; all are for-credit offerings designed to meet the professional development needs of specific audiences. No admission to the university is required.

Other options include non-credit and continuing education programs such as short courses, computer training, or customized programs for businesses and other groups. No admission to the university is required to enroll in these programs.

Evening Degree Programs

Some graduate degree programs offer late afternoon and evening courses for students who are unable to attend classes during the day. These students may also have the option of earning their degree through Distance Education. For further information about these programs, students should contact the specific department.

Alternative Teacher Education Programs

Alternative teacher education programs are for people with a desire to teach in elementary, middle, or high schools but do not have an undergraduate degree in education. Please note that all alternative licensure programs at NCSU require a minimum GPA of 2.50 and a four-year degree from an accredited college or university. There are two types of alternative licensure: licensure only and lateral entry.

Licensure only programs are for people who want to complete their teaching license ("A"-level) before entering the classroom. These programs include education coursework, content-specific coursework, and student teaching.

Lateral entry programs are for people who want to work on their coursework while teaching full-time. Lateral entry programs include education coursework, content-specific coursework, and a one-hour practicum in place of student teaching. Participants in lateral entry programs will receive a lateral entry license when they are hired in a teaching position and then will be recommended for a clear ("A"-level) license upon completion of the lateral entry program. There are two types of lateral entry programs offered at NCSU. The traditional lateral entry program can be completed over the course of three years. The NC TEACH program is an intensive one-year program in which participants enter as a cohort and are provided with an extensive support network to aid their transition into the classroom.

REGISTRATION

Course Load

Fall and Spring Semesters

A full-time graduate course load is nine to 15 credits per semester (including audits). Graduate students holding assistantships, however, have additional course load restrictions

Summer Sessions

Graduate students are not required to be registered in summer sessions. If they are full time in the previous spring semester and are continuing their graduate study in the following fall semester, they are considered to be full time in the summer. If a student needs to be registered, one credit hour is considered full time.

International Students

The U.S. Citizenship and Immigration Services (USCIS) requires international students on F-1 and J-1 visas to carry a full-time course of study to remain in status.

Course loads and assistantships

Graduate students holding assistantship appointments are restricted to 9 hours per semester if they hold an appointment of one-half-time or greater and 12 hours per semester if they hold a one-quarter-time appointment. With advance written permission from the Graduate School, a student may take more than the maximum semester course load during a particular semester if the total credit hours do not exceed the maximum for the term of the appointment.

Full-Time/Part-Time Determination for All Graduate Students

NC State uses a uniform Schedule of Full-Time Status of Graduate Students for Loan Deferment, Financial Aid, Payroll Tax Withholding and Veteran's Benefits Purposes. To maintain consistency throughout the university system, faculty members do not have the authority to submit individual letters verifying the status of a graduate student. This schedule will be the only resource used to determine a student's status for these purposes. Registration and Records in Room 1000, Harris Hall processes all student loan deferments. The Graduate School will not be directly involved in preparing loan deferment letters.

These definitions apply to all graduate students, U.S. and international, participants and non-participants in the Graduate Student Support Plan.

Fall and Spring Semesters

Classification	Full-Time	Half Time
Non-Thesis Master's	Registration for nine (9) or more credit hours per Fall or Spring semester, or a minimum of three (3) hours per semester during the semester in which the student is completing the last course(s) required to complete the degree. Students who have completed[1] all credit hour requirements for their degree must register for three (3) hours of XXX 689 (Non-Thesis Master Continuous Registration – Full Time Registration). Students may register for this course a maximum of one semester.	Registration for 3-8 credit hours per Fall or Spring semseter, or one (1) hour of XXX 688 (Non-Thesis Master's Continuous Registration-Half Time Registration) for students who have completed[3] all credit hour requirements for their degree.
Thesis Master's	Registration for nine (9) or more credit hours per Fall or Spring semester, or a minimum of three (3)	Registration for 3-8 credit hours per Fall or Spring semester, or one

	hours per semester during the semester in which the student is completing the last course(s) required to complete the degree. For thesis students, this could include XXX 695. Students who have completed[2] all credit hour requirements (including research credits) for their degree except for completing their research and/or writing and defending the thesis should register for three (3) hours of XXX 699 (Master's Thesis Preparation) each semester until graduation.	(1) hour of XXX 699 (Master's Thesis Preparation) for students who have completed[4] all credit hour requirements (including research credits) for their degree and are completing their research and/or writing and defending the thesis.
Doctorate	Registration for nine (9) or more credit hours per Fall or Spring semester until the student completes all credit hour requirements for the degree, including research credits, and the oral preliminary examination, or three (3) hours per semester of XXX 899 (Doctoral Dissertation Preparation) for students who have completed[5] all credit hour requirements for their degree (including research credits and the oral preliminary examination) except for completing their research and/or writing and defending the dissertation.	Registration for 3-8 credit hours per Fall or Spring semester, or one (1) credit of XXX 899 for students who have completed[6] all credit hour requirements for their degree (including research credits and the oral preliminary examination) except for completing their research and/or writing and defending the dissertation.

[1]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for three (3) hours of 689 and be considered full time.
[2]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for three (3) hours of 699 and be considered full time.
[3]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for one (1) hour of 688 and be considered half time.
[4]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for one (1) hour of 699 and be considered half time.
[5]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for three (3) hours of 899 and be considered full time.
[6]Students with an IN grade who have successfully completed all of the remaining degree requirements that are listed above are also eligible to register for one (1) hour of 899 and be considered half time.

Summer Sessions

Graduate students are not required by the University to be registered during the summer. However, students who receive a stipend but who are not enrolled in the University during a period of five weeks or more are subject to Social Security tax withholding. In particular, this means that Social Security taxes will be withheld from the paychecks of Graduate Research Assistants (RAs) who do not register in the summer. Specifically, Social Security taxes will be withheld in June for RAs who are not registered in Summer Session I and in July for RAs who are not registered in Summer Session II. The source of funds that pays the stipend must pay the same amount of Social Security tax as is withheld from the student's paycheck during these months.

Two special registration categories are available for Graduate Research Assistants who would not otherwise take courses in the summer: XYZ 696 (Summer Thesis Research) and XYZ 896 (Summer Dissertation Research), where XYZ represents the course prefix of a specific department or program. Each of these courses is for 1 hour of credit, with registration for 10 weeks, beginning the first day of Summer Session I. Social Security taxes will not be withheld from the June or July paychecks of RAs who register for either 696 or 896.

Please note that student who are not registered during the summer do not have access to financial aid during that period, nor do they have access to the Student Health Service unless they pay the student health fee for each of the two summer sessions.

Accelerated Bachelor's/Master's Degree Program

The objective of the Accelerated Bachelors/Master's (ABM) degree program is to provide a means by which exceptional undergraduate students at NC State may complete the requirements for both the Bachelor's and

Masters degrees at an accelerated pace. It provides an opportunity for exceptional undergraduate students at NC State to double count up to 12 credits and obtain a non-thesis Master's degree in the same field within 12 months of completing the Bachelor's degree or obtain a thesis based Master's degree in the same field within 18 months of completing the Bachelor's degree.

Students interested in the ABM Program should contact their department.

Continuous Registration

After a student is admitted to the Graduate School and enrolls for the first time, she/he is required to maintain continuous registration, i.e., be enrolled each semester, excluding summer sessions, until she/he has either graduated or her/his graduate program at NC State has been terminated. All students who graduate during the second summer session must be registered for either the first or second summer session.

Leave of Absence

A student in good academic standing who must interrupt her/his graduate program for good reasons may request a leave of absence from graduate study for a definite period of time not to exceed one year within a given graduate program. 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 Graduate School, the student would 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 (6) years for Master's and ten (10) for doctoral.

Termination

Graduate students whose programs have been terminated because of failure to maintain continuous registration and who have not been granted a leave of absence during a fall or spring semester will be required to reapply for admission, and pay the admission fee ($65.00 for US Citizens and Permanent Residents or $75.00 for Non-Resident Aliens [Internationals]), if they wish to resume their graduate studies at NC State.

Adding Courses

Courses may be added during the first week of a semester, via Pack Tracks alone, or during the second week, via Pack Tracks and with permission of the instructor. In a summer session, courses may be added during the first two days via Pack Tracks alone, and/or during the third and fourth days via Pack Tracks with permission of the instructor. To add a student to a course after the deadline for adding courses, an instructor must submit a Schedule Revision Form to the School/College or Graduate Dean's approval.

Dropping Courses

All 500-800 level courses may be dropped through Pack Tracks without grades during the first eight weeks of a semester and during the first two weeks of a summer session. Students and advisors should consult the specific Registration and Records calendar for drop deadlines. Students should make schedule changes as early as possible in the semester. The number of hours for which a student is officially enrolled and upon which tuition and fees are based is that number in which the student is enrolled at the end of the second week of classes of a semester and at the end of the fifth day of a summer session (the last day to withdraw or drop a course with a refund). A Schedule Revision Form is required to drop a course after the deadline. No dropping of courses shall be allowed except for documented medical reasons or other verified, unforeseen grounds of personal or family hardship. Making such exceptions to policy requires the recommendation of the chair of the student's advisory committee, the DGP or Department Head, and the Dean of the Graduate School. Courses may not be dropped after the final grades have been submitted by the instructor and processed by Registration and Records.

Dropping Minicourses

The drop date for a five-week minicourse is the last day of the third week of the mini-course. The drop date for a seven-week minicourse is the last day of the fourth week of the minicourse. Instructors teaching

minicourses (courses which last only a portion of the semester) should announce at the outset of these courses their appropriate drop deadlines.

Course Numbering

Graduate-level courses are numbered at the 500, 600, 700 and 800 levels. Courses at the 500- and 600-level are available to advanced undergraduate students in the Accelerated Bachelor's/Master's (ABM) Degree Program and to students holding Bachelor's degrees. Courses at the 700 and 800 level are doctoral courses and are open only to students holding Bachelor's degrees. Exceptions may be made for undergraduate students in honors program and seniors in the ABM Program. Consent of the department is required for enrollment in all 600- and 800-level courses. Refer to the NC State University Courses Catalog for course descriptions and prerequisites.

Note: Courses at the 500 and 700 level are letter graded. Students cannot enroll in these courses for "credit only".

Grading and Academic Standing

The Grading System

NC State University uses the following grading system:

Grade	Grade Points/Credit Hour
A+	4.33
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D+	1.33
D	1.00
D-	0.67
F	0.00

Grade Point Average (GPA)

The number of credit hours at the 400-level of higher that are attempted in a semester or summer session (for which regular grades are received) is divided into the total number of grade points earned to arrive at the grade point average. The cumulative and semester GPAs will include the effect of any A+ grades awarded (at 4 1/3 grade points) up to a grade point average of 4.000. The GPA will be calculated to three decimal points. Credits earned in PBS classification are also included in the GPA calculations and the determination of academic standing that become part of the Plan of Graduate Work.

Graduate Credit

To receive graduate degree credit, a grade of "C-" or higher is required in all courses taken after admission. Grades on courses taken for graduate credit as an undergraduate at NC State, in PBS classification, or transferred from other universities must have a grade of "B" or better to be transferred. All grades on courses numbered 400 and above taken in a graduate classification or for graduate credit as an undergraduate are

included in the graduate GPA. Courses at the 300 level and below are not eligible for graduate credit and subsequently do not affect the graduate GPA. To graduate, a student must have a minimum 3.00 average on all graduate course work as well as all courses on his or her Plan of Graduate Work.

Graduate students who take 400-level courses that are letter graded do not have the option of taking the courses for "credit only" if they intend for the course to be part of their Plan of Graduate Work. It is appropriate for them to take selected 400-level letter-graded courses that are required by the program but will not be included in the Plan of Graduate Work for S-U grade. Examples would be 400-level courses in the student's major and FLE courses.

Grading of Graduate Courses

5XX	Letter Graded Master's Courses
6XX	S-U Graded Master's Courses
7XX	Letter Graded Doctoral Courses (ALL 7XX courses are restricted to the following classification of students (class MR, DR, SR, SP and GR)
8XX	S-U Graded Doctoral Courses (ALL 8XX courses with the exception of those specifically listed at the end of this section are restricted to the following classification of students class MR, DR, SR, SP and GR)
9XX	Professional Courses in the College of Veterinary Medicine (not covered by this document)

NOTE: Courses at the 500 and 700 level are letter graded. Students cannot enroll in these courses for "credit only".

Incompletes

The grade of "IN" (Incomplete) may be given in any course at the discretion of the instructor for work not completed because of a serious interruption in the student's work not caused by their own negligence. An "IN" must not be used, however, as a substitute for an "F" when the student's performance in the course is not passing. An "IN" is only appropriate when the student's record in the course is such that the successful completion of particular assignments, projects, or tests missed as a result of a documented serious event would enable that student to pass the course. Only work missed may be averaged into the grades already recorded for that student.

A student who receives an "IN" must complete the unfinished work to have the Incomplete converted to a final grade by the end of the next semester in which the student is enrolled, provided that this period is not longer than 12 months from the end of the semester or summer session in which the "IN" was received. Otherwise, the "IN" will be automatically converted to "F" or "U," in accord with the grading approved for the particular course. All grades of "IN" must be cleared prior to graduation. Students must not register again for any courses in which they have "IN" grades. Such registration does not remove "IN" grades, and the completion of the course on the second occasion will automatically result in an "F" for the incomplete course.

Except in the case of Interinstitutional Registration, grades on courses transferred from another institution will not be included in computing the GPA.

Grade Changes

When submitted to the Department of Registration and Records, end-of-course grades are final and not subject to change by reason of a revision of the instructor's judgment; nor are submitted grades to be revised on the basis of a second trial (e.g., a new examination or additional work undertaken or completed). Changes may only be made within one calendar year after the date final grades were submitted in order to correct an error of computation or transcribing or where part of the student's work has been unintentionally overlooked.

Academic Warning, Probation and Termination

Graduate students are given a notice of academic warning if they have accumulated less than nine hours at the 400 level or above and have less than a 3.00 GPA. Graduate students are placed on academic probation if they accumulate nine or more but less than 18 credit hours at the 400 level or above and have a grade point average of less than 3.00 GPA. A student's graduate study is terminated if 18 or more credit hours at the 400 level or above are accumulated with a grade point average of less than 3.00 GPA. In the case of program termination, no further registration in a graduate classification will be permitted. Under extenuating circumstances the student will be reinstated upon the written recommendation of the department and approval by the Graduate Dean. Departments have the prerogative of recommending the termination of a student's graduate admission at any time if the student is not making satisfactory progress toward the degree.

Students who are eligible to attend the first summer session are eligible to attend either or both summer sessions. For example, students who receive a notice of "Graduate Admission Terminated" at the end of the first summer session may register for second summer session unless the major department recommends otherwise.

Eligibility for Assistantship, Fellowship or Traineeship

A graduate student must be in good academic standing (3.00 GPA or better) to be eligible for appointment to an assistantship, fellowship or traineeship and must be registered in each semester in which the appointment is in effect.

Audits

Graduate students wishing to audit a course must have the approval of their advisor and of the department offering the course. While auditors receive no course credit, they are expected to attend class regularly. The degree to which an auditor must participate in class beyond regular attendance is optional with the instructor. Any auditing requirements should be clearly explained in writing to the student at the beginning of the semester. Should an instructor conclude that an auditor has failed to fulfill the stipulated requirements, the instructor is justified in marking NR (no recognition given for an audit) on the final grade report.

Audits (AU) in subjects in which the graduate student has had no previous experience will be evaluated at full credit value in determining course loads. Audits taken as repetition of work previously accomplished are considered at one-half their credit value in calculating course loads. With the single exception of foreign language audits, all audit registration must fall within the maximum permissible course loads. While audit registrations are evaluated for purposes of determining permissible course loads in terms of the regulations of the Graduate School, the University Cashier's Office considers all audits, except one permitted free of charge, in terms of full credit value in calculating tuition.

Graduation

There are three official graduations 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 spring and fall semesters, but any student who graduated the preceding second summer session is eligible to participate in the December commencement. All students scheduled to graduate in the fall or spring semesters are strongly encouraged to attend the respective commencement. Any doctoral candidate wishing to have the degree conferred in absentia must notify the Graduate School in writing; Master's candidates should contact their departments or programs.

Diplomas

Students graduating in the spring and fall are awarded their diplomas during the commencement exercises. The diplomas for those students graduating at the end of second summer session or those students receiving permission to receive the degree in absentia are mailed by the Department of Registration and Records, which is also responsible for the ordering of diplomas.

Students earning a Master of Arts, Master of Science, Doctor of Education or Doctor of Philosophy degree will

receive diplomas designating the degree but not the major or program of study. Students earning Master's degrees in a designated field will receive diplomas indicating the field of specialization, i.e., Master's of Forestry.

Students with co-majors will have those identified on their transcripts, but not on their diplomas.

Diploma Order Request Cards

To order a diploma, a student must obtain a Diploma Order Request Card (DOR) from their Department Graduate Secretary. For thesis students, the completed DOR must be submitted to their Department along with the Final Oral Exam Report. Non-thesis students must submit the DOR with their Option B Form. The department will process both forms and forward them to the Graduate School by the deadline noted in the Graduate School Calendar. Until a Diploma Order Request form is filed, a diploma cannot be ordered.

Interinstitutional Registration Program

NC State participates in an Interinstitutional Registration program with the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro, the University of North Carolina at Charlotte, North Carolina Central University, and Duke University. The program provides the opportunity for students to enroll at another institution for a course or courses not offered on their home campus. Other activities include a cooperative library arrangement, joint student activities, and faculty cooperation and interchange.

Even though taking a course on another campus, the student is exclusively under the administrative direction of the NC State Graduate School. Enrollment for courses on other campuses will take place on this campus, using an InterInstitutional Approval form from Registration and Records. Such courses are considered by the Graduate School to be a part of the student's normal load and the student will be billed for the courses through the NC State University Cashier's Office. During the summer, the procedure is somewhat different in that a student must be enrolled in a least one course on the NC State campus during the same session as the requested interinstitutional registration.

When the grading system of the other institutions varies from that of NC State, grades received under Interinstitutional Registration will be converted to the NC State system. "H," "P," "L, and "F" grades earned at the University of North Carolina at Chapel Hill and "E," "G," "S" and "F" grades earned at Duke University will be converted to "A," "B," "C" and "F" grades, respectively.

Cooperating Raleigh Colleges

The Cooperating Raleigh Colleges (CRC) is a voluntary organization composed of NC State, Meredith College, Peace College, St. Augustine's College, and Shaw University. Graduate programs are currently offered only at NC State and Meredith College, but graduate students can enroll at either institution for a course or courses not offered by their home campus.

Any NC State graduate degree student who is enrolled in at least three graduate credit hours on the NC State campus may take a course at Meredith College during fall or spring semester, provided that

1. the course is not taught on the NC State campus, and
2. the advisory committee considers the course educationally desirable.

NC State students may not register for more than a total of two courses in any semester at Meredith, and not more than six of the required academic credits for a Master's degree at NC State may be accepted from that institution. Grades from Meredith are not used in computing a student's NC State grade point average.

Under this agreement, regular tuition and fees are paid to NC State. Special fees may be required for specific courses at Meredith, and the student is responsible for paying these fees.

Academic Common Market

The Academic Common Market (ACM) is a cooperative agreement among universities in 16 states in the southeastern United States. The ACM allows a student to enroll in a graduate program at a university in another state without having to pay out-of-state tuition if that program of study is neither

1. offered by the public institutions in the student's home state, nor
2. commonly available in the other southeastern states.

North Carolina State University

Graduate Catalog

Graduate Programs

The Graduate School offers programs of study leading to both Master's and doctoral degrees. 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. Emphasis is placed upon the student's scholarly development through formal course work, seminars, research and independent investigation.

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. It is the responsibility of *ALL* graduate students to know and understand their degree requirements. Students are responsible for the fulfillment of those requirements.

MASTER'S DEGREE PROGRAMS

Master of Science and Master of Arts

All Master of Science and Master of Arts degree programs are planned with the objective of making possible a reasonable, comprehensive mastery of the subject matter in a chosen field. In most cases, the Master of Science and Master of Arts programs provide training and experience in research in order to familiarize the student with the methods, ideals and goals of independent investigation. In these cases, representative of most Master of Science and Master of Arts degree programs, a thesis is required. A small number of Master of Science and Master of Arts programs do not require a thesis.

Requirements

1. A minimum of 30 semester hours of graduate work in the degree program, unless the specific program requires more hours.
2. A reading knowledge of a foreign language (in a few programs)
3. A comprehensive written examination (in some programs)
4. A thesis (in most programs)
5. A comprehensive oral examination (except Option B programs)

Time Limit

Requirements for *ALL* Master's degrees must be completed within six (6) calendar years. For further information about the time limit for degrees, please see Administrative Handbook Section 3.4.

Master's Degree in a Designated Field

A number of departments and programs offer Master's degrees in designated fields. These are professional degrees and do not require a thesis.

Requirements

1. A minimum of 30 semester hours of graduate work in the degree program (unless the specific program requires more hours).
2. A comprehensive written examination (in some programs)
3. A comprehensive oral examination (except Option B programs)

Option B Master's Degree

The Option B Master's degree requires that students adhere to the general guidelines for a Master of Arts or Master of Science degree with the following exceptions:

1. A comprehensive oral exam is not required
2. A thesis is not required
3. Departmental research credit hours will not be included as part of the course work
4. No more than six hours of independent study credits can be included in the 30-hour minimum
5. Individual departments define other requirements for their Option B program, such as additional course work or final projects
6. Option B Master's degree programs may not carry an officially designated minor
7. Students have a single assigned advisor rather than an advisory committee.

Credit Hour Requirements for Master's Degrees

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

1. No more than two credit hours of departmental seminar (S/U graded) may be included in the minimum 30-credit program.
2. No more than three credit hours of Master's supervised teaching (685) may be included in the minimum 30-credit program.
3. Programs that require a thesis may include no more than six hours of Thesis Research credit (695) in the minimum 30-credit-hour program. Thesis Research credit is not appropriate in non-thesis programs.
4. Non-thesis programs may include no more than six hours of independent study credits in the minimum 30-credit program.
5. No more than ten hours of 400-level courses may be counted toward the minimal 30-hour requirement, and they may not come from the major field.
6. Non-Thesis Master's Continuous Registration - Half-Time Registration (688) credits may not be used to satisfy the 30-credit hour requirement.
7. Non-Thesis Master's Continuous Registration - Full-Time Registration (689) credits may not be used to satisfy the 30-credit hour requirement.
8. Non-thesis Master's Examination (690) credits may not be used to satisfy the 30-credit hour requirement.
9. Master's Thesis Preparation (699) credits may not be used to satisfy the 30-credit hour requirement.
10. At least 18 hours of the minimum 30 hours required for the Master's degree must be graduate credits earned while the student is enrolled in a graduate classification at NC State.
11. At least 18 hours of the 30 hour requirement may not have been, and may not be, used to satisfy degree requirements for another Master's degree at NC State.
12. Also, at least 18 of the 30 hour requirement may not have been taken while the student was enrolled in another Master's degree program, unless the student did not complete the other program. In addition, students pursuing a Master's degree after having completed a doctoral degree at NC State must complete at least 18 graduate credit hours at NC State after enrollment in the Master's program.
13. The remaining 12 credit hours, or more depending on the requirements of the specific program, may be transferred from any of the following sources or any combination thereof.

Transfer Credits

Transfer of graduate credits earned at other universities

A course that was completed at another college or university may be considered for transfer to a Master's program provided that the course is classified as a graduate course; it was completed while the student was in a graduate or post-baccalaureate classification; the grade in the course is "B" (3.00 on a 4.00 scale) or better; the college or university is accredited by one of the following six U.S. regional accrediting agencies: the Southern Association of Colleges and Schools, the Middle States Association of Colleges and Schools, the New England Association of Colleges and Schools, the North Central Association of Colleges and Schools, the Northwest Association of Colleges and Schools, or the Western Association of Colleges and Schools.

Transfer of graduate credits earned while enrolled in an undergraduate program at NC State University

A course that was completed while the student was enrolled as an undergraduate at NC State University may be considered for transfer to a Master's program, provided that it is at the 400-level or higher, that the grade is "B" (3.00 on a 4.00 scale) or better, that it was not counted to fulfill undergraduate requirements, and that it is recommended by the Director of Graduate Programs at the time of the student's enrollment in the Graduate

School. Students admitted to the Accelerated Bachelor's/Master's program may use up to 12 hours of graduate credit to satisfy requirements for both the bachelor's and the Master's degrees. No graduate credit will be allowed for a course completed in an undergraduate classification at another institution.

Transfer of graduate credits earned while enrolled in a previous graduate degree program at NC State University

A graduate course that was completed while the student was enrolled in a previous graduate program at NC State University may be considered for transfer to a Master's program, provided that it is at the 500-level or higher and that the grade is "B" (3.00 on a 4.00 scale) or better.

Transfer of Post-Baccalaureate Studies (PBS) graduate credits earned at NC State University

A graduate course that was completed while the student was enrolled in PBS status at NC State University may be considered for transfer to a Master's program provided that it is at the 500-level or higher and that the grade is "B" (3.00 on a 4.00 scale) or better. All PBS credits that are used to satisfy requirements of a specific Master's degree must be earned before the student is admitted to that degree program.

Master's Advisor and Advisory Committee

All students in graduate programs must have a graduate advisor who is a member of the Graduate Faculty in the student's major program and is appointed by the Dean of the Graduate School upon recommendation of the DGP. In the case of Master's programs requiring theses and/or final oral examinations, the graduate advisor serves as chair or co-chair of the committee.

The primary function of the committee is to advise the student in all aspects of the educational program and to monitor and evaluate that student's progress toward the degree. The committee should provide an intellectually stimulating foundation for the student's professional and scholarly development and should be sensitive to any difficulties in the student's progress, research performance or methodology requiring attention. The committee certifies whether the student has met NC State's standards for a graduate degree. Advising and guiding the student on how best to qualify for the requirements of a degree is a key part of this responsibility.

In all Master's programs except those designated "Option B," the committee will consist of at least three NC State Graduate Faculty members, one of whom is designated as chair and one of whom represents the minor if one has been declared. Those Master's programs designated "Option B" require that the student choose only a major advisor or co-advisors but no committee.

Plan of Work

The Graduate School does not require that all Master's students submit a Plan of Work (POW). However, Master's students are encouraged to complete a POW in consultation with their advisor as soon as possible after the completion of one half of their course work. The Graduate School reserves the right to request a POW under some circumstances. In this capacity, the POW serves as a contract between the student and his or her graduate program, reducing the possibility of any later misunderstanding as to fulfilling degree requirements.

Whether submitted optionally or as part of the degree requirement, the POW should include both a list of the course work to be undertaken (in all programs) and the thesis or dissertation topic (except in non-thesis programs); be developed by the student and his/her advisory committee; be approved by the committee and the DGP or Department Head prior to submission to the Graduate School for final approval; be submitted (optional) prior to completion of one-half the total Master's program, or (mandatory) upon completion of 12 hours of a doctoral program.

Language Requirement

Requirements for Master of Arts and Master of Science Students

A reading knowledge of one modern foreign language (Germanic, Romance or Slavic) is required by some

programs for the Master of Science and Master of Arts degrees. Other programs may designate that the language requirement be filled from among those languages in which the Department of Foreign Languages and Literatures conducts testing. Students should contact the major program for specific language requirements.

Master's Degrees in Designated Fields

There is no language requirement in the professional Master's degree programs (Master's degrees in designated fields) with the exception of the Master's of International Studies, which requires knowledge of one foreign language at a level of conversational proficiency.

Minor

The Graduate School does not require a minor, though individual programs may require one. If a program does not require a minor, the graduate student has the option of choosing one, except in an Option B Master's program. The minor work will usually be from a single discipline or field that in the judgment of the advisory committee provides relevant support to the major field. However, the committee has the alternative of developing an interdisciplinary minor if it best serves the needs of the student. When a student does select a minor, the advisory committee must include a representative of the minor field. The minor credits on the Plan of Graduate Work must be approved by the graduate advisory committee member representing the minor, and, in some cases, the DGP from the minor program.

Co-Major

Students may co-major at the Master's level in programs with identical degrees, although the degrees do not necessarily have to have identical requirements, e.g., two master of science programs, one with a thesis requirement and one without. Students must obtain the approval of both graduate programs as well as appropriate representation on the advisory committee, and must meet all requirements of both programs. Students who co-major are not required to declare a minor. Co-majors must meet all requirements for majors in both programs. One degree is awarded and the co-major is noted on the transcript.

Master's Comprehensive Examination

Written Examination

Written examinations covering the subject matter of the major and the minor may be required. Information concerning written examination schedules should be obtained from the student's program.

Oral Examination

Candidates for Master's degrees, except those in Option B programs, 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 minor fields and that this knowledge can be used with promptness and accuracy. This exam takes the form of a traditional defense of the thesis in those programs requiring theses. In programs that require a thesis, the thesis must be submitted in complete form, except for such revisions which may be necessary as a result of the final oral exam, to all members of the advisory committee at least two (2) weeks prior to the exam.

Failure of a student to pass the oral examination terminates the student's graduate work at NC State unless the graduate advisory committee unanimously requests that the Graduate School permit a re-examination. Only one re-examination will be given.

Thesis

Candidates for the Master of Arts or Master of Science degrees in programs requiring a thesis must undertake an original investigation into a subject, which has been approved by the student's advisory committee and DGP,

and prepare a thesis. Information on form and organization of the thesis, in addition to other regulations, is presented in the University's on-line Thesis and Dissertation Guide.

Time Limit

All requirements for the Master's degree 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 academic college/school or program. The term limit remains at six (6) years even if a student was on approved leave of absence during the six-year period. For further information about the time limit for degrees, please see Administrative Handbook Section 3.4.

Summary of Master's Procedures

All Master's Students

1. Application materials and required fees received
2. Application materials reviewed by graduate program
3. Graduate program forwards recommendation regarding applicant's admissibility to the Dean of the Graduate School
4. The Dean of the Graduate School reviews the recommendation and the student is notified of the action taken on the request for admission
5. Outstanding transcripts, if any, showing any or all post-secondary coursework attempted and degree(s) conferred since application should be submitted by student to the Graduate School, prior to matriculation
6. Student arrives, reports to the graduate program, is assigned a graduate advisor and develops a roster of courses and credits with the advisor
7. Student subject to continuous registration policy until graduation
8. Student signs and submits Patent Agreement
9. Program encouraged by Graduate School to require student to develop a Plan of Graduate Work, in consultation with and with the approval of his/her graduate advisor and DGP. If submitted via GARS to the Graduate School, Graduate Records staff will review the Plan of Graduate Work and advise the program of any changes that would need to be made before the Request for a Permit to Schedule the Master's Oral Examination or Request for Option B Graduation Checkout can be approved by the Graduate School
10. Student passes language examination, if required
11. Student passes written examination, if required
12. Student submits Diploma Order Request form by end of third week of the semester or summer session of anticipated graduation
13. A GPA of at least 3.00 for the degree requirements as well as on overall graduate course work at NC State is required for graduation
14. All degree requirements must be completed within six calendar years, beginning with the date the student takes courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the program or academic college/school.

Students in Thesis Programs

1. Graduate advisory committee of three or more Graduate Faculty members is appointed by the DGP.
2. A preliminary copy of the thesis is submitted to the chair of the student's advisory committee
3. 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 DGP submits to the Graduate School the Request for a Permit to Schedule the Master's Oral Examination

4. If Graduate School requirements are met, the Request for a Permit to Schedule the Master's Oral Examination is approved by the Graduate School within 10 working days of receipt of the request, and the permit, Admission to the Final Master's Oral Examination, is issued
5. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the thesis, if required, to the other members of the advisory committee for review
6. Final examination is scheduled and conducted
7. The Admission to the Final Master's Oral Examination form is completed by the committee members, including date and result, and submitted to the Graduate School by the DGP. The Graduate School should receive the report within five working days of the examination
8. Student submits three copies of the thesis, signed by each member of his/her advisory committee, to the Graduate School
9. The deadline for submitting the thesis to the Graduate School in order for the student to graduate in a given semester or summer session appears in the Graduate School Calendar
10. The thesis is reviewed by the Graduate School to ensure that the format conforms to the specifications prescribed in the Thesis and Dissertation Guide.

Students in Master's of Discipline Non-Thesis Programs

1. Graduate advisory committee of three or more Graduate Faculty members is appointed by the DGP
2. When all requirements except completion of the course work in the final semester are satisfied, DGP submits to the Graduate School the Request for a Permit to Schedule the Master's Oral Examination
3. If Graduate School requirements are met, a Request for a Permit to Schedule the Master's Oral Examination is approved by the Graduate School within 10 working days of receipt of the request and the permit, Admission to the Final Master's Oral Examination, is issued
4. Final examination is scheduled and conducted
5. Final examination report, including date and result of the examination, submitted to the Graduate School by the DGP. The Graduate School should receive the report within five working days of the examination
6. The deadline date for unconditionally passing the final examination in order for the student to graduate in a given semester or summer session appears in the Graduate School Calendar.

Students in Option B Programs

DGP submits requests for graduation checkout to the Graduate Dean no later than six weeks after the first day of the semester (seven working days after the first day of the summer session) in which the student is taking the last course in his or her program and anticipates graduation.

DOCTORAL DEGREE PROGRAMS

Doctor of Philosophy and Doctor of Education Degrees

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 preliminary examinations in the field of specialization and related areas of knowledge, and successfully defending the dissertation.

Requirements

1. At least two residence credit points secured in continuous semesters' residence as a graduate student at the University.
2. Doctoral degrees at North Carolina State University require a minimum of 72 graduate credit hours beyond the Bachelor's degree. For a student who has a Master's degree from a university other than NC State, a maximum of 18 hours of relevant graduate credit from the Master's degree may be applied toward this minimum, upon the recommendation of the student's Graduate Advisory Committee. If a student completes a Master's degree at NC State and continues for a doctoral degree without a break in time, up to 36 credit hours taken while in Master's status may be used to meet minimum requirements for the doctoral degree.
3. A preliminary comprehensive examination (written and oral components)
4. A dissertation
5. A final comprehensive oral examination
6. Dissertation defense.

Residence Credits

A student working toward a doctoral degree is expected to be registered for graduate work at NC State for at least six (6) semesters beyond the Bachelor's degree. The University has basic residence requirements, as defined below, but the academic schools/colleges have the prerogative of establishing more restrictive requirements within the respective schools/colleges. Residence credit is determined by the number of semester hours of graduate work carried during a regular semester.

Semester Credits (Hours)	Residence Credits
9 or more	1
6-8	2/3
less than 6 (including registration in 590, 690 series)	1/3

At least two residence credits are necessary in continuous residence (registration in consecutive semesters) as a graduate student at the University, but failure to take courses in the summer does not break continuity.

Summer Residency

Summer course work, however, can be used in partial fulfillment of this requirement. A single summer session is equal to one-half of the corresponding amount for a regular semester. For example, six semester hours

carried during a summer session will earn one-third of a residence credit; less than six credit hours will earn one-sixth of a residence credit.

Doctoral Advisor and Advisory Committee

All students in graduate programs must have a graduate advisor who is a member of the Graduate Faculty in the student's major program and is appointed by the Dean of the Graduate School upon recommendation of the DGP. The graduate advisor serves as chair or co-chair of the committee.

The primary function of the committee is to advise the student in all aspects of the educational program and to monitor and evaluate that student's progress toward the degree. The committee should provide an intellectually stimulating foundation for the student's professional and scholarly development and should be sensitive to any difficulties in the student's progress, research performance or methodology requiring attention. The committee certifies whether the student has met NC State's standards for a graduate degree. Advising and guiding the student on how best to qualify for the requirements of a degree is a key part of this responsibility.

A doctoral student's committee will consist of at least four NC State Graduate Faculty members, one of whom represents the minor field if a minor has been declared. The committee is indicated on the Plan of Graduate Work. In this way, the committee is officially recommended by the DGP, and must be approved by the Graduate School at the time of the approval of the Plan of Graduate Work.

Plan of Work

Doctoral students are required to complete a Plan of Work (POW) in consultation with their advisors. The doctoral POW, including the courses to be undertaken in the student's program and the dissertation topic, should be prepared by the doctoral student and his/her advisory committee and submitted electronically to the Graduate School. The POW as a whole should be rationally unified, with all constituent parts contributing to an organized plan of study and research, and courses must be selected from groups embracing one principal subject of concentration, the major, with the option of designating courses in a cognate field, the minor. When a student elects to designate a minor, he/she should select the minor course work from a discipline or field that, in the judgment of the advisory committee, provides relevant support to the major field.

The POW should include both a list of the course work to be undertaken (in all programs) and the dissertation topic; be developed by the student and his/her advisory committee; be approved by the committee and the DGP or Department Head prior to submission to the Graduate School for final approval; be submitted prior to completion of 12 hours of a doctoral program.

External Minor

Minors granted at the doctoral level for work completed at another institution are called "external minors." Typically, in these cases a doctoral student at NC State wishes to have course work from a prior extradisciplinary Master's program at another university approved as the minor for their current doctoral degree. The DGP must recommend a representative at NC State from the discipline of the proposed external minor to both serve on the advisory committee and to review and determine whether the course work is sufficient to constitute the minor at the doctoral level.

Co-Major

Students may co-major at the doctoral level with the approval of both programs and with the appointment of a co-chair from each program on the advisory committee. Co-majors are not permitted between Doctor of Philosophy and Doctor of Education degree programs. Co-majors must meet all requirements for majors in both programs. One degree is awarded and the co-major is noted on the transcript.

Candidacy

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

Comprehensive Examinations

Preliminary Examinations

Each doctoral student is required to take preliminary or comprehensive examinations, consisting of written examinations and an oral examination, 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.

Written examination questions 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 his/her field and the adequacy of preparation for research. Committee members must notify the DGP when a student has completed the written examination. Failure to pass the written portion terminates the student's work at this institution, subject to departmental and/or school/college 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, the student submits a Request to Schedule the Doctoral Oral Examination, indicating that he/she wishes to schedule the preliminary examination.

The preliminary oral examination is conducted by the student's advisory committee and the Graduate School Representative and is open to all Graduate Faculty members. The Graduate School will notify the student and the examining committee. 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 conditioned, 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 (refer to NC State policy on grievance procedures for students).

Failure to pass the preliminary oral examination terminates the student's work at this institution 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 in a given doctoral program.

Final Oral Examination

As with the preliminary oral examination, the chair of the student's advisory committee is in charge of conducting the 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.

The examination consists of the candidate's defense of the methodology used, the data collected, and the conclusions reached in the research, as reported in the dissertation. It is conducted by an examining committee, which consists of the student's advisory committee and a Graduate School Representative. This examination is open to the University community.

While the chair has the option of allowing visitors to ask questions of the candidate, the chair also has the obligation to maintain a scholarly atmosphere and to keep the student's best interest foremost. Graduate Faculty members who are not on the advisory committee will have the opportunity to express their opinions to the committee in the absence of the student. However, the final deliberations and the vote are private to the examining committee.

A unanimous vote of approval of the advisory committee is required for passing the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements prescribed by the

student's advisory committee. Failure of a student to pass the examination terminates his or her work at this institution unless the advisory committee recommends a reexamination. No reexamination may be given until one full semester has elapsed and only one reexamination is permitted.

Dissertation

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

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the Graduate School. Information on the required form and organization of the dissertation, in addition to other regulations, is presented in the University's Thesis and Dissertation Guide. At the time of the dissertation's submission to the Graduate School, the student is also required to submit one copy each of the Survey of Earned Doctorate form and University Microfilms International Agreement form and to complete a brief, standard questionnaire about his or her experience as a graduate student at NC State. The University also requires that all doctoral dissertations be microfilmed by University Microfilms International, Ann Arbor, MI, including the publication of the abstract in Dissertation Abstracts International. The student pays the cost of this service.

Time Limit

Doctoral students must attain candidacy for the degree within six (6) calendar years. All degree requirements must be completed within ten (10) calendar years. For further information about the time limit for degrees, please see Administrative Handbook Section 3.4.

Summary of Doctoral Procedures

1. Application materials and required fee received
2. Application materials reviewed by graduate program
3. Graduate program forwards recommendation regarding applicant's admissibility to Graduate Dean
4. The graduate program's recommendation is reviewed and the student is notified of the action taken on the request for admission
5. Outstanding transcripts, if any, showing any or all post-secondary coursework attempted and degree(s) conferred since application should be submitted by student to the Graduate School, prior to matriculation
6. If admitted, the student arrives, reports to the graduate program, is assigned an advisor and makes out a roster of courses in consultation with the departmental advisor and DGP
7. Advisory committee of at least four NC State Graduate Faculty members, one of whom is designated as the chair and one of whom represents the minor field (where appropriate), is appointed by the Graduate Dean upon the recommendation of the DGP. The Graduate Dean also selects a Graduate Faculty member to serve as the Graduate School Representative on the student's committee
8. Student signs and submits Patent Agreement
9. A dissertation subject is selected and an outline of the proposed research is submitted to the student's advisory committee and the DGP for review and approval
10. Plan of Graduate Work is prepared by the advisory committee with the student, is approved by the DGP, and is submitted to the Graduate School for approval as soon as feasible after completion of 12 hours of course work
11. 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. The results of these examinations will be reported to the Graduate School

12. When all written examinations have been completed satisfactorily, the chair submits the Request for Approval to Schedule the Doctoral Oral Examination, designating the preliminary oral examination, at least two weeks prior to the suggested date. Upon approval of the request, the student and examining committee are notified of the time and place. The DGP sends the report of the exam to the Graduate School and if the exam is passed without conditions, the student is admitted to candidacy
13. A copy of the preliminary draft of the dissertation is submitted to the chair of the student's advisory committee for review.
14. The Diploma Order Request Form must be filed with the Graduate School by the end of the sixth week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's failure to receive the diploma at graduation
15. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the dissertation to advisory committee members for review
16. Four calendar months or its equivalent after admission to candidacy or later, and after the dissertation is complete except for such revisions as may be necessary as a result of the final exam, the chair submits to the Graduate School the Request for Approval to Schedule the Doctoral Oral Examination, designating a request for permission for the candidate to take the final oral exam. Requests should be filed at least two weeks before the date of the examination. Upon approval of the request, the student and the examining committee, including a Graduate School representative, are notified of the time and place of the examination. The Graduate School Representative receives a copy of the dissertation at least one week prior to the examination
17. The Graduate School requires that all theses and dissertations be submitted electronically following the requirements in the ETD website (electronic thesis and dissertation). Specific deadlines for each semester, as well as formatting requirements, are posted in the online Thesis and Dissertation Guide, located within the ETD website.
18. The dissertation is reviewed by the Graduate School to ensure that the format conforms to the specifications prescribed in the Thesis and Dissertation Guide.
19. All course work scheduled in a graduate degree classification must be completed prior to graduation
20. A GPA of at least 3.00 is required for graduation.
21. All degree requirements must be completed within ten (10) 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 program or academic college/school.

North Carolina State University

Graduate Catalog

Registration

The Department of Registration and Records must have authorization from the Graduate School before a graduate student in any classification will be permitted to register for classes. This authorization will be sent to the Department of Registration and Records at the time the student is notified of acceptance for graduate study. All students attending classes must be registered for credit or audit. Grade records are furnished the students at the end of each scheduled school term.

North Carolina State University

Graduate Catalog

Tuition and Fees

The University Cashier's Office provides billing, financial aid disbursement and account management services to all students. All students paying tuition and fees are entitled to University services, facilities and programs, including the services, facilities, and programs offered by the Student Center, Health Services, Physical Education Department, and Athletics Department.

Residence for Tuition Purposes

North Carolina State University

Graduate Catalog

Financial Aid

Graduate students may receive financial support through fellowships, traineeships and teaching or research assistantships sponsored by federal, state and private agencies. A graduate student must be in good academic standing (3.0 GPA or better) to be eligible for appointment to an assistantship, fellowship, or traineeship and must be registered in each semester in which the appointment is in effect. There are also minimum registration requirements for eligibility for tuition and health insurance benefits.

Assistantships
Fellowships
Graduate Student Support Plan

Financial Aid Office

The Office of Scholarships and Financial Aid (OSFA) assists students and parents in applying for and securing financial assistance when family resources are insufficient to meet educational expenses. The OSFA offers assistance with any part of the financial aid process (including scholarships, grants, loans and campus employment), as well as providing financial aid counseling assistance.

NORTH CAROLINA STATE UNIVERSITY

THE GRADUATE SCHOOL

Graduate Degrees | Minors | Graduate Certificates | Courses or Other Support to Graduate Programs

Fields Offering Graduate Degrees

The Graduate School offers major programs of study in the following fields. Except where noted by an exception in parentheses, these programs required the Graduate Records Examination (GRE) scores and will not take action on applications unless accompanied by scores for at least the GRE General (Aptitude) Test (verbal, quantitative and analytical):

Accounting - MR (GMAT)
Adult and Community College Education - EdD, MS, MEd (GRE)
Aerospace Engineering - PhD, MS (GRE)
Agricultural and Extension Education - EdD (GRE)
Agricultural and Resource Economics - MS (GRE (required if requesting financial aid))
Agricultural Education - MS, MR (GRE)
Analytics - MS (GRE General Test)
Animal Science - MS, MR (GRE)
Animal Science & Poultry Science - PhD (GRE)
Anthropology - MA (GRE)
Applied Mathematics - PhD, MS (GRE and GRE Subject Test (not required but strongly encouraged))
Architecture - MR (GRE (exceptions apply; contact program))
Art and Design - MR

Biochemistry - PhD, MS, MR (GRE)
Bioinformatics - PhD, MR (GRE)
Biological and Agricultural Engineering - PhD, MS, MR (GRE (exceptions apply; contact program))
Biomathematics - PhD, MS, MR (GRE)
Biomedical Engineering - PhD, MS (GRE, TOEFL for internationals)
Botany - PhD, MS, MR (GRE)
Business Administration - MR (GMAT)

Chemical Engineering - PhD, MS, MR (GRE)
Chemistry - PhD, MS, MR (GRE (not required but strongly encouraged))
Civil Engineering - PhD, MS, MR (GRE)
Communication - MS (GRE)
Communication Rhetoric and Digital Media - PhD (GRE)
Comparative Biomedical Sciences - PhD, MS (GRE)
Computer Engineering - PhD, MS (GRE; TOEFL > 575 Internationals)
Computer Networking - MS (GRE, GRE Subject Test recommended for aid)
Computer Science - PhD, MS, MR (GRE, GRE Subject Test recommended for PhD and aid)
Counselor Education - PhD, MS, MEd (GRE or MAT)
Counselor Education, Agency Counseling - MS, MEd (GRE or MAT)
Counselor Education, Student Personnel in Higher Education - MS, MEd (GRE or MAT)
Creative Writing - MFA (GRE)
Crop Science - PhD, MS, MR (GRE)

Curriculum and Instruction - PhD, MS, MEd (GRE (PhD); GRE or MAT (MEd and MS))
Curriculum and Instruction, English Education - MS, MEd (GRE or MAT)
Curriculum and Instruction, Reading - MS, MEd (GRE or MAT)
Curriculum and Instruction, Social Studies Education - MS, MEd (GRE or MAT)

Design - PhD (GRE)

Economics - PhD, MA, MR (GRE)
Educational Administration and Supervision - EdD (GRE or MAT)
Educational Research and Policy Analysis - PhD (GRE)
Electrical Engineering - PhD, MS (GRE; TOEFL > 575 Internationals)
Elementary Education - MS, MEd (GRE or MAT)
Engineering - MR (entrance exam not required)
English - MA (GRE general test; analytical writing)
Entomology - PhD, MS, MR (GRE)
Extension Education - MS, MR (GRE)

Fiber and Polymer Science - PhD (GRE)
Financial Mathematics - MR (GRE and GRE Math Subject Test)
Fisheries and Wildlife Sciences - PhD, MS, MR (GRE)
Food Science - PhD, MS, MR (GRE)
Forestry - PhD, MS, MR (GRE)
French Language and Literature - MA (Candidates must prove fluency in French.)
Functional Genomics - PhD, MS, MR (GRE)

Genetics - PhD, MS, MR (GRE)
Global Innovation Management - MR (GMAT)
Graphic Design - MR (GRE (exceptions apply; contact program))

Higher Education Administration - MS, MEd, EdD (GRE)
History - MA (GRE)
Horticultural Science - PhD, MS, MR (GRE)
Human Development & Family Studies-Family Life & Parent Educ - MS (GRE)
Human Resource Development - MS (GRE)

Immunology - PhD, MS (GRE)
Industrial Design - MR (GRE (not required but strongly encouraged))
Industrial Engineering - PhD, MS, MR (GRE)
Instructional Technology - Computers - MS, MEd (GRE or MAT (MEd and MS))
Integrated Manufacturing Systems Engineering - MR (GRE (exceptions apply; contact program))
International Studies - MR (GRE)

Landscape Architecture - MR (GRE (not required but strongly encouraged))
Liberal Studies - MA (entrance exam not required)

Marine, Earth, and Atmospheric Sciences - PhD, MS (GRE; GRE and GRE Subject Test for disciplines in Biological Oceanography and Geology)
Materials Science and Engineering - PhD, MS, MR (GRE (exceptions apply; contact program))
Mathematics - PhD, MS (GRE and GRE Subject Test (not required but strongly encouraged))
Mathematics Education - PhD, MS, MEd (GRE)
Mechanical Engineering - PhD, MS, MR (GRE)
Microbial Biotechnology - MR (GRE)
Microbiology - PhD, MS, MR (GRE)
Middle Grades Education - MS, MEd (GRE or MAT)

Natural Resources - MS, MR (GRE)
Nuclear Engineering - PhD, MS, MR (GRE (exceptions apply; contact program))
Nutrition - PhD, MS, MR (GRE)

Operations Research - PhD, MS, MR (GRE)

Parks, Recreation, and Tourism Management - PhD, MS, MR (GRE)
Physics - PhD, MS (GRE and GRE Subject Test)
Physiology - PhD, MS, MR (GRE)
Plant Biology - PhD, MS, MR (GRE)
Plant Pathology - PhD, MS, MR (GRE)
Poultry Science - MS, MR (GRE)
Psychology - PhD, MS (GRE. The GRE Subject Test is no longer required, but is strongly encouraged, especially for non-psychology majors. MAT not required but strongly encouraged.)
Public Administration - PhD, MR (GRE)
Public History - MA (GRE)

School Administration - MR (GRE or MAT)
Science Education - PhD, MS, MEd (GRE or MAT (MS, MEd); GRE (PhD))
Social Work - MR (GRE or MAT (required under certain conditions; contact department))
Sociology - PhD, MS, MR (GRE)
Soil Science - PhD, MS, MR (GRE required for US students, recommended for internationals)
Spanish Language and Literature - MA (Candidates must prove fluency in Spanish.)
Special Education - MS, MEd (GRE and MAT)
Special Education, Behavior Disorders - MS, MEd (GRE or MAT)
Special Education, Learning Disabilities - MS, MEd (GRE or MAT)
Special Education, Mental Retardation - MS, MEd (GRE or MAT)
Specialized Veterinary Medicine - MR (GRE)
Statistics - PhD, MS, MR (GRE)

Technical Communication - MS (GRE)
Technology Education - MS, MEd, EdD (GRE or MAT)
Textile Chemistry - MS (GRE)
Textile Engineering - MS (GRE)
Textile Technology Management - PhD (GRE or GMAT)
Textiles - MS, MR (GRE)
Toxicology - PhD, MS, MR (GRE)
Training and Development - MEd (GRE)

Veterinary Public Health - MR

Wood and Paper Science - PhD, MS, MR (GRE (exceptions apply; contact program))

Zoology - PhD, MS, MR (GRE)

Departments not normally requiring GRE scores may in special instances require their submission as additional information to be used in making a judgment of the student's potential for success in a graduate program.

Fields Offering Minors

The following fields and units, while not offering graduate degrees, support graduate education by offering graduate minors:

Artificial Intelligence
Biotechnology
Cognitive Science
Computational Engineering and Science
Ecology
Environmental Remote Sensing and Image Analysis
Food Safety
Geographic Information Systems
Interdisciplinary
Life Science Ethics
Plant Physiology
Solid State Sciences
Water Resources
Women's & Gender Studies

Departments not normally requiring GRE scores may in special instances require their submission as additional information to be used in making a judgment of the student's potential for success in a graduate program.

Fields Offering Graduate Certificates

The following fields and units, while not offering graduate degrees, support graduate education by offering graduate certificates:

Agricultural Education
Community College Teaching
Design and Analysis of Environmental Systems: Watershed Assessment and Restoration
Geographic Information Systems
Horticultural Science
Molecular Biotechnology
Nonprofit Management
Nonwovens Science and Technology
Program Development in Family Life Education
Training and Development

Departments not normally requiring GRE scores may in special instances require their submission as additional information to be used in making a judgment of the student's potential for success in a graduate program.

Fields Offering Courses or Other Support to Graduate Programs

The following fields and units, while not offering graduate degrees, support graduate education by offering graduate courses or in some other capacity:

Biological Sciences

Education
Foreign Languages and Literatures
Multidisciplinary Studies
Philosophy

Accounting

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Accounting					Y		

GRADUATE FACULTY

F. A. O. Buckless, ***Department Head***

Director of Graduate Programs:
K. A. Krawczyk, Box 8113, 515.4439, katherine_krawczyk@ncsu.edu, Accounting

Professors: J. W. Bartley, M. S. Beasley, B. C. Branson, F. A. O. Buckless, Y. A. Chen, K. A. Krawczyk, D. P. Pagach, R. L. Peace, R. B. Sawyers, P. F. Williams; ***Associate Professors:*** M. Bradford, R. L. Wright, G. J. Zuckerman; ***Assistant Professors:*** J. F. Brazel, K. R. Nunez, R. Pennington, E. Z. Taylor

The Master of Accounting (MAC) is a professional degree designed to prepare students for careers in public accounting, in the accounting and finance divisions of major corporations, and in education, government, and non-profit institutions. Job titles of recent graduates include Staff Accountant, Internal Auditor, Financial Analyst, Budget Analyst, Cost Accountant, Tax Specialist, Assistant Controller, SBI Agent, State Auditor, and Internal Revenue Agent. Graduates will also be prepared to complete the CPA Examination.

Admission Requirements: Admission to the MAC program is competitive. The best-qualified applicants will be accepted up to the number of spaces available for new students. The Admissions Committee evaluates candidates on criteria such as

- undergraduate academic record and grade point average;
- GMAT score*;
- relevant activities and/or work experience; and
- presence, leadership, integrity, and other personal characteristics.

[*The Admissions Committee requires all applicants who score below 500 on their first attempt to retake the exam prior to the application deadline.]

Individuals with a Bachelor's degree in any major may apply to the program; however, any applicant without a Bachelor's degree in accounting must complete a series of undergraduate accounting prerequisites before qualifying as a MAC degree candidate. More complete information can be found on the MAC website.

Master's Degree Requirements: Students complete a 12-course sequence in one year that includes ten graduate-level accounting courses and two non-accounting MBA courses (31 total credit hours). The curriculum is designed to provide a broad-based professional education. Students can choose to obtain a concentration in Information Technology.

Other Relevant Information: Masters students must begin the degree program in the summer or in the fall semester. The program is primarily designed for full-time students, and most classes meet during the day. A limited part-time option, where students complete the program in two years, is also available.

All application materials are due by one of two application deadlines--**February 1** for consideration in both the MAC Fellowship and Scholarship programs; **March 1** for all other applicants.

GRADUATE COURSES

ACC 508 Advanced Commercial Law
ACC 510 Accounting for Mergers and Acquisitions
ACC 511 Accounting for Derivatives and Hedging
ACC 515 Accounting Theory and Current Issues
ACC 519 Integrated Accounting Practice
ACC 521 Production Cost Analysis and Control
ACC 525 Advanced Management Accounting
ACC 530 Advanced Income Tax
ACC 533 Accounting and Tax Research Methodology
ACC 534 Taxation of Corporations and Shareholders
ACC 535 Taxation of Partnerships and S Corporations
ACC 536 Taxation of Estates, Trusts and Gifts
ACC 537 Tax Planning and Business Strategy
ACC 540 IT Risks and Controls
ACC 551 Advanced Auditing
ACC 552 Advanced Accounting Cases
ACC 580 Survey of Accounting
ACC 588 Special Topics in Accounting
ACC 600 Managerial and Career Effectiveness
ACC 630 Independent Study
ACC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ACC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

NCSU Graduate Catalog

Adult and Higher Education

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Adult and Community College Education		Y	Y			Y	
Higher Education Administration		Y	Y			Y	
Human Resource Development			Y				
Training and Development						Y	

GRADUATE FACULTY

C. E. Kasworm, ***Department Head***

Director of Graduate Programs:
L. G. Sullivan, Box 7801, 515.6241, lgsullivan@ncsu.edu, Adult & Higher Education

W. Dallas Herring Distinguished Professor of Community College Education: L. G. Sullivan

Professors: D. Akroyd, C. E. Kasworm, K. M. Moore; ***Adjunct Professors:*** K. M. Kolasa, D. G. Oblinger; ***Professors Emeriti:*** G. A. Baker III, E. J. Boone, M. P. Burt, G. L. Carter Jr., J. C. Glass Jr., G. B. Vaughan; ***Associate Professors:*** J. Bartlett, J. Gaston-Gayles, T. G. Hatcher, B. S. Mehlenbacher; ***Research Associate Professors:*** J. L. Burrow; ***Adjunct Associate Professors:*** B. I. Mallette; ***Assistant Professors:*** T. A. Bowles, S. Bracken, A. N. Bryant, D. D. Chapman, A. J. Jaeger, T. O'Driscoll, J. Storberg-Walker, C. A. Wiessner; ***Visiting Assistant Professors:*** D. C. Luckadoo; ***Adjunct Assistant Professors:*** D. W. Bailey, B. Brown, P. H. Clayton, T. E. H. Conway, C. C. Figuers, L. D. Hunt Jr., M. A. Jablonski, D. S. Jackson, C. W. Johnson, L. D. Krute, T. R. Luckadoo, D. McGraw, L. Moneta, M. H. Nadelman, J. M. Pettitt, C. D. Raubenheimer, D. L. Reichard, D. J. Rodas, S. W. Williams

ASSOCIATE MEMBERS OF THE PROGRAM

Professors Emeriti: R. D. Mustian, R. W. Shearon; ***Associate Professors Emeriti:*** R. T. Liles

The department offers degrees in adult and community college education, higher education administration, and training and development to meet the professional needs of leaders, administrators, program specialists, instructors, and consultants in community colleges, four-year colleges and universities, business and industry, and other adult and higher education organizations. Program specializations include adult and continuing education, community college leadership and higher education, health professions education, training and development, community college teaching, and student affairs.

Admission Requirements: In addition to Graduate School admission requirements, the department requires the student to submit GRE results (no older than five years). Specific information regarding admission can be obtained at the department's website: ced.ncsu.edu/ahe/admissions.htm.

Master's Degree Requirements: The M.S. and M.Ed. programs require a minimum of 36 semester hours. The Master of Science degree requires a final oral examination and thesis approved by the student's graduate committee.

Doctoral Degree Requirements: Students must have completed a Master's degree before being admitted to the doctoral program. The Ed.D. degree requires a minimum of 72 semester hours of which a maximum of 12 are dissertation. Students are expected to be advanced to candidacy no later than their sixth year and to complete all

degree requirements no later than the end of the tenth year. For more specific information on departmental admissions: ced.ncsu.edu/ahe/admissions.htm.

Student Financial Support: Information on financial aid at NC State may be found at www7.acs.ncsu.edu/financial_aid.

GRADUATE COURSES

EAC 532 Health Care Delivery in the United States
EAC 535 Curriculum and Instruction in the Health Professions
EAC 536 Issues and Trends in Education for the Health Professions
EAC 538 Instructional Strategies in Adult and Community College Education
EAC 539 Teaching in the Online Environment
EAC 540 Foundations of Student Affairs
EAC 541 Administration and Finance of Student Affairs
EAC 542 Student Characteristics and the College Environment
EAC 543 Student Development Theory
EAC 551 Research in Adult and Higher Education
EAC 552 College Student Retention
EAC 555 Ethics in the Workplace and Education
EAC 556 Organization Change in HRD: Theory and Practice
EAC 559 The Adult Learner
EAC 580 Designing Instructional Systems in Training and Development
EAC 582 Organization and Operation of Training and Development Programs
EAC 583 Needs Assessment and Task Analysis in Training and Development
EAC 584 Evaluating Training Transfer and Effectiveness
EAC 585 Integrating Technology into Training Program
EAC 586 Methods and Techniques of Training and Development
EAC 587 Marketing for Education and Training Programs
EAC 593 Advanced Instructional Design in Training and Development
EAC 595 Special Topics
EAC 602 Seminar in Adult and Community College Education
EAC 624 Topical Problems in Adult and Community College Education
EAC 630 Research Seminar in Adult and Community College Education
EAC 641 Practicum in Health Occupations
EAC 651 Internship in Adult and Community College Education
EAC 685 Master's Supervised Teaching
EAC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
EAC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
EAC 692 Master's Research Project
EAC 693 Master's Supervised Research
EAC 695 Master's Thesis Research
EAC 696 Summer Thesis Research
EAC 699 Master's Thesis Preparation
EAC 700 Community College and Two-year Postsecondary Education
EAC 701 Administrative Concepts and Theories Applied to Adult and Community College Education
EAC 703 The Programming Process in Adult and Community College Education
EAC 704 Leadership in Higher and Community College Education
EAC 705 Group Process in Adult and Community College Education
EAC 706 The College and University Presidency
EAC 707 The Politics of Higher Education
EAC 708 Continuing Education for the Professions
EAC 710 Adult Education: History, Philosophy, Contemporary Nature
EAC 711 Reflective Practice and Research Inquiry
EAC 712 The Change Process in Adult Education
EAC 716 History of Higher Education in the United States
EAC 717 Current Issues in Higher Education
EAC 720 Use of Secondary Survey Data in Adult and Higher Education
EAC 737 The Extension and Public Service Function in Higher Education
EAC 739 Educational Gerontology
EAC 743 Adulthood and Learning: The Later Years
EAC 745 Death and Dying: A Lifespan Issue
EAC 749 Finance in Higher Education

EAC 750 The Environment for Learning in Adult and Community College Education
EAC 759 Adult Learning Theory
EAC 765 Current Issues in Adult Education
EAC 767 Education of Special Adult Populations
EAC 778 Law and Higher Education
EAC 779 Concepts and Principles of Evaluation Applied to Non-formal Adult Education Programs
EAC 785 Qualitative Research in Adult and Community College Education
EAC 787 Organizational Theories and Concepts in Higher Education
EAC 790 Advanced Qualitative Research Methods
EAC 802 Research Seminar in Adult and Community College Education
EAC 803 Research Seminar in Adult and Higher Education
EAC 824 Topical Problems in Adult and Community College Education
EAC 841 Practicum In Health Occupations
EAC 851 Internship in Adult and Community College Education
EAC 885 Doctoral Supervised Teaching
EAC 890 Doctoral Preliminary Examination
EAC 892 Doctoral Research Project
EAC 893 Doctoral Supervised Research
EAC 895 Doctoral Dissertation Research
EAC 896 Summer Dissertation Research
EAC 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Agricultural and Extension Education

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Agricultural and Extension Education		Y					
Agricultural Education			Y		Y		
Extension Education			Y		Y		

GRADUATE FACULTY

J. L. Flowers, ***Interim Department Head***

Director of Graduate Programs:
G. E. Moore, Box 7607, 515.1756, gary_moore@ncsu.edu, Agricultural & Extension Education

Professors: G. W. Bostick Jr., J. L. Flowers, B. M. Kirby, T. T. McKinney, G. E. Moore; ***Adjunct Professors:*** M. Baker, J. S. Lee; ***Professors Emeriti:*** D. M. Jenkins, R. D. Mustian, R. W. Shearon; ***Associate Professors:*** D. B. Croom, L. Guion, R. M. Stewart, E. B. Wilson; ***Associate Professors Emeriti:*** C. D. Bryant, R. T. Liles; ***Assistant Professors:*** K. Jayaratne, D. W. W. Jones, M. Kistler, J. Rayfield; ***Adjunct Assistant Professors:*** D. A. Boone, D. D. Peasley, J. Smith

The Agricultural and Extension Education Department provides advanced study for professionals in agricultural education, extension education or related careers. Programs of study are designed to meet the individual needs of the student. Courses may be selected that lead to advanced teacher licensure in agriculture or an emphasis in extension education leading to advancement in careers in the Cooperative Extension Service. Additional specialization in the student's teaching or extension field is provided through a minor or advised elective courses. The following graduate programs are available in the Department:

Graduate Certificate in Agricultural Education (requires 15 hours)
Master of Science in Agricultural Education (requires 36 hours including a thesis)
Master of Science in Extension Education (requires 36 hours including a thesis)
Master of Agricultural Education (requires 36 hours)
Master of Extension Education (requires 36 hours)
Master of Agricultural Education (a 100% internet-based degree program offered in cooperation with North Carolina A&T State University, requires 36 hours)
Sixth-Year Certificate in Agricultural Education
Doctor of Education in Agricultural and Extension Education

Admission Requirements: In addition to the Graduate School admission requirements, the department requires either GRE or the Miller's Analogies Test (MAT) scores (for M.S. and Ed.D. degrees only), three positive references, and a statement of career goals and/or research interests. An interview (personal or by telephone) may be required.

Master's Degree Requirements: The Department offers an M.S. degree, which requires a thesis for which the student receives six hours of credit, and a Master of Agricultural Education and a Master of Extension Education as a non-thesis track. All Master's degree programs require a total of 36 credit hours. The Master of Science in Extension Education and the Master of Extension Education require a core of 21 hours (AEE 501, 505, 521, 523, 526, 577, and 578). The Master of Science in Agricultural Education and the Master of Agricultural Education require a core of 18 hours (AEE 501, 505, 526, 528 or 529, 535 or 735, and 578). Minors are optional but, if selected, require a minimum of nine credit hours.

Graduate Certificate Requirements: The Department also offers a graduate certificate in agricultural

education. This certificate program involves completion of 15 credit hours. Students are to choose from AEE 500, 503, 521, 522, 528, 529, 535, 641, and 735.

Sixth-Year Certificate: The Department offers an array of courses that are recognized by the Department of Public Instruction as comprising a Sixth-Year Certificate. Students are required to complete 24 hours of advanced graduate work past the Master's degree. Contact the Director of Graduate Programs for details.

Doctoral Degree Requirements: A Doctor of Education degree in Agricultural and Extension Education is offered. A minimum of 72 hours past the Bachelor's degree is required. More hours may be required based upon the past degrees and experiences of the candidate. The student's graduate committee will determine the specific courses needed. At least six hours of statistics is required. Twelve hours of credit is earned for writing the dissertation.

Student Financial Support: A limited number of research and/or teaching assistantships are available on a competitive basis. Other financial aid is available from the Office of Financial Aid and on a competitive basis from the Graduate School.

Other: The graduate courses listed below are available live, online, or both. Students should refer to the current Pack Tracks information or to the AEE graduate program website.

GRADUATE COURSES

AEE 500 Agricultural Education, Schools and Society
AEE(ED) 501 Foundations of Agricultural and Extension Education
AEE 503 Youth Program Management
AEE 505 Trends and Issued in Agricultural and Extension Education
AEE 507 Comparative Agricultural and Extension Education
AEE 521 Program Planning in Agricultural and Extension Education
AEE 522 Occupational Experience in Agriculture
AEE 523 Adult Education in Agriculture
AEE 526 Information Technologies in Agricultural and Extension Education
AEE 528 Instructional Design in Agricultural and Extension Education
AEE 529 Curriculum Development in Agricultural and Extension Education
AEE(ED) 530 Priority Management in Agricultural and Extension Education
AEE 534 Mentoring in Agricultural and Extension Education
AEE(ED) 535 Teaching Agriculture in Secondary Schools
AEE 560 Organizational and Administrative Leadership in Agricultural and Extension Education
AEE 577 Evaluation in Agricultural and Extension Education
AEE 578 Scientific Inquiry in Agricultural and Extension Education
AEE 579 Research Design in Agricultural and Extension Education
AEE 595 Special Topics in Agricultural and Extension Education
AEE 601 Seminar
AEE 610 Special Topics
AEE 611 Special Topics in Agricultural Communications
AEE 620 Special Problems
AEE(ED) 641 Practicum in Agricultural and Extension Education
AEE 685 Master's Supervised Teaching
AEE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
AEE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
AEE 690 Master's Examination
AEE 693 Master's Supervised Research
AEE 695 Master's Thesis Research
AEE 696 Summer Thesis Research
AEE 699 Master's Thesis Preparation
AEE(ED) 735 Effective Teaching in Agriculture and Life Sciences
AEE 740 Extension in Developing Countries
AEE 820 Special Problems
AEE(ED) 841 Practicum in Agricultural and Extension Education
AEE 885 Doctoral Supervised Teaching
AEE 893 Doctoral Supervised Research

AEE 895 Doctoral Dissertation Research
AEE 896 Summer Dissertation Research
AEE 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Analytics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Analytics			Y				

GRADUATE FACULTY

Director of Graduate Programs:
M. A. Rappa, Box 7268, 424.4550, mrappa@ncsu.edu, Institute for Advanced Analytics

Alan T. Dickson Distinguished University Professor: M. A. Rappa

Professors: D. A. Dickey, C. P. Jones; ***Associate Professors:*** J. B. Earp, L. A. Williams

The Master of Science in Analytics (MSA) is an intensive 10-month professional degree designed to give students a thorough understanding of the tools, methods, and applications of advanced analytics. It is both focused and practical in orientation, and seeks to provide training directly relevant to industry. Its educational objectives include but are not limited to topics, such as data quality and integration, data and text mining, time series forecasting, optimization, and other areas of statistics; business intelligence methods involving reporting, query and analysis, online analytical processing, data storage, and visualization; and an understanding of data security and privacy, and ethical issues. Students are provided hands-on experience using the same complex analytics tools used in industry today. Student team projects aim to provide experience with solving complex analytical problems in industry and in other areas of science, medicine and engineering, such as financial intelligence, fraud detection, warranty analysis and risk management; marketing optimization and customer analytics; simulating and optimizing supply chain flows, dynamic pricing, production control and service quality improvement; web analytics; evidence-based medicine; biological data analysis; data mining for network intrusion detection or software engineering.

Admission Requirements: Admission to the MSA program is highly competitive. The best-qualified applicants will be accepted up to the limited number of spaces available for students each year. The Admissions Committee evaluates candidates on criteria such as:

- overall academic record and grade point average;
- academic performance in analytical/quantitative subjects;
- GRE General Test score;
- relevant employment experience and potential to succeed in the profession; and
- leadership, integrity, and other personal character traits.

Individuals with a Bachelor's degree in any major may apply to the program; however, an applicant without prior coursework in statistics, mathematics, computer programming, would need to complete a set of prerequisite courses before qualifying as a candidate for admission. More information can be found on the MSA website.

Master's Degree Requirements: Students complete 30 credit hours of defined coursework in a period of ten months beginning in Summer Session II and ending the following Spring semester. The integrated curriculum is designed to provide a focused professional education in the tools, methods and applications of data analytics.

Other Relevant Information: Students must begin the degree program in the first semester (Summer Session II) and complete all 30 credit hours of the curriculum. The program is designed for full-time students only. All application materials are due by January 1 (December 1 for international applicants).

GRADUATE COURSES

AA 591a Advanced Analytics 1 - Introduction
AA 591b Advanced Analytics 2 - Methods I
AA 591c Advanced Analytics 3 - Applications I
AA 591d Advanced Analytics 4 - Practicum I
AA 591e Advanced Analytics 5 - Methods II
AA 591f Advanced Analytics 6 - Applications II
AA 591g Advanced Analytics 7 - Practicum II

NCSU Graduate Catalog

Animal Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Animal Science			Y		Y		

GRADUATE FACULTY

R. L. McCraw, ***Interim Department Head***

Director of Graduate Programs:
C. E. Farin, Box 7621, 515.4022, char_farin@ncsu.edu, Animal Science

William Neal Reynolds Professor: J. Odle
William Neal Reynolds Professor Emeritus: E. J. Eisen

Professors: B. P. Alston-Mills, L. S. Bull, J. C. Cornwell, J. H. Eisemann, K. L. Esbenshade, C. E. Farin, W. L. Flowers, B. A. Hopkins, R. L. McCraw, W. E. M. Morrow, R. M. Petters, M. H. Poore, O. W. Robison, M. T. See, J. W. Spears, S. P. Washburn, L. W. Whitlow, C. M. Williams; ***Visiting Professors:*** D. E. Pritchard; ***Adjunct Professors:*** M. Choct, B. Roush, T. A. van Kempen; ***Professors Emeriti:*** K. R. Butcher, E. V. Caruolo, R. G. Crickenberger, R. W. Harvey, W. L. Johnson, J. R. Jones, C. A. Lassiter, J. G. Lecce, R. D. Mochrie, R. M. Myers, F. D. Sargent, J. C. Wilk, G. H. Wise; ***Associate Professors:*** V. Fellner, G. B. Huntington, S. W. Kim, J. Luginbuhl, J. A. Moore, P. D. Siciliano, C. H. Stahl, E. van Heugten, C. S. Whisnant; ***Adjunct Associate Professors:*** R. J. Harrell; ***Associate Professors Emeriti:*** E. U. Dillard, J. J. McNeill; ***Assistant Professors:*** M. S. Ashwell, J. P. Cassady, M. E. Hockett, H. Liu, S. E. Pratt, J. E. Turner; ***Research Assistant Professors:*** L. Xi; ***Adjunct Assistant Professors:*** D. S. Casey, R. O. Maguire

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: G. W. Almond, W. J. Croom, Jr., W. M. Hagler, Jr., D. K. Larick, J. Piedrahita; ***Professors (USDA):*** J. C. Burns; ***Associate Professors:*** G. A. Benson, M. D. Whitacre

Animal science offers an opportunity for training in a diversity of basic sciences and the integration of such knowledge into the framework of a living system. Students may major or co-major in animal science or one of the following disciplines: biochemistry, genomics, genetics, microbiology, nutrition, physiology or statistics. Students may also concentrate in management and production areas.

Admission Requirements: Factors considered for admission include: grade point average, scores on the GRE (for M.S. and Ph.D. applicants), undergraduate courses, letters of recommendation and a member of the Animal Science Department faculty willing to serve as the applicant's advisor.

Master of Science: A minimum of 30 credit hours of graduate work in the degree program is required. The minor is optional and external faculty representation is not required on the advisory committee.

Master of Animal Science: The non-thesis Master of Animal Science degree requires a minimum of 36 credit hours, of which a minimum of 9 credits are in Animal Science courses at the 500 or above level and 3 to 6 credits are for a research project (ANS 610).

Doctoral Degree Requirements: The department offers a Ph.D. program in Animal Science and Poultry Science with a concentration in Animal Science.

Student Financial Support: A limited number of research and teaching assistantships are available through the department and are awarded on a competitive basis. Students may also be supported by research grant funds awarded to faculty members. Students applying for assistantships are advised to apply by February 15 for fall admission.

Other Relevant Information: To provide an opportunity for students to develop their teaching skills, all graduate students are required to assist in the departmental teaching program, regardless of source of financial support.

GRADUATE COURSES

ANS 500 Advanced Ruminant Nutrition
ANS(NTR) 516 Animal Nutrition Research Methods
ANS 520 International Livestock Production
ANS 530 Advanced Applied Animal Reproduction
ANS 531 Advanced Applied Animal Reproduction Lab
ANS(NTR) 550 Applied Ruminant Nutrition
ANS 553 Growth and Development of Domestic Animals
ANS(FS, NTR) 554 Lactation and Milk Consumption
ANS(BCH) 571 Regulation of Metabolism
ANS 590 Special Topics
ANS 601 Animal Science Seminar
ANS(CBS,PHY,ZO) 602 Seminar in Biology of Reproduction
ANS 603 Reproductive Physiology Seminar
ANS 604 Animal Breeding and Genetics Seminar
ANS 610 Special Topics
ANS 641 Practicum in Animal Science
ANS 685 Master's Supervised Teaching
ANS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ANS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ANS 690 Master's Examination
ANS 693 Master's Supervised Research
ANS 695 Master's Thesis Research
ANS 696 Summer Thesis Research
ANS 699 Master's Thesis Preparation
ANS(PHY) 702 Reproductive Physiology of Mammals
ANS 706 Mammalian Embryo Manipulation
ANS(GN) 708 Genetics of Animal Improvement
ANS(NTR) 709 Energy Metabolism
ANS 710 Advanced Livestock Management
ANS(GN) 713 Quantitative Genetics and Breeding
ANS(CBS,NTR,PHY) 764 Advances in Gastrointestinal Pathophysiology
ANS(NTR,PO) 775 Mineral Metabolism
ANS(PHY) 780 Mammalian Endocrinology
ANS(NTR) 785 Digestion and Metabolism in Ruminants
ANS 790 Advanced Special Topics
ANS 801 Animal Science Seminar
ANS(CBS,PHY,ZO) 802 Seminar in Biology of Reproduction
ANS 803 Reproductive Physiology Seminar
ANS 804 Animal Breeding and Genetics Seminar
ANS 810 Special Topics
ANS 841 Practicum in Animal Science
ANS 885 Doctoral Supervised Teaching
ANS 890 Doctoral Preliminary Examination
ANS 893 Doctoral Supervised Research
ANS 895 Doctoral Dissertation Research
ANS 896 Summer Dissertation Research
ANS 899 Doctoral Dissertation Preparation

Animal Science & Poultry Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Animal Science & Poultry Science	Y						

GRADUATE FACULTY

Directors of Graduate Programs:
C. E. Farin, Box 7621, 515.4022, char_farin@ncsu.edu, Animal Science
J. T. Brake, Box 7608, 515.5060, jbrake@ncsu.edu, Poultry Science

William Neal Reynolds Distinguished Professor and Director of Graduate Programs ANP and PSC: J. T. Brake
William Neal Reynolds Professor: J. Odle
William Neal Reynolds Professor Emeritus: E. J. Eisen

Professors: B. P. Alston-Mills, K. E. Anderson, L. S. Bull, V. L. Christensen, J. C. Cornwell, W. J. Croom Jr., F. W. Edens, J. H. Eisemann, K. L. Esbenshade, C. E. Farin, P. R. Ferket, W. L. Flowers, J. L. Grimes, W. M. Hagler Jr., G. B. Havenstein, B. A. Hopkins, R. L. McCraw, W. E. M. Morrow, J. F. Ort, S. L. Pardue, C. R. Parkhurst, J. N. Petitte, R. M. Petters, M. H. Poore, O. W. Robison, M. T. See, B. W. Sheldon, J. C. H. Shih, T. D. Siopes, J. W. Spears, S. P. Washburn, L. W. Whitlow, C. M. Williams, M. J. Wineland; ***Visiting Professors:*** D. E. Pritchard; ***Adjunct Professors:*** W. L. Bryden, K. K. Krueger, S. M. Shane, Z. Uni; ***Professors Emeriti:*** K. R. Butcher, T. A. Carter, E. V. Caruolo, R. G. Crickenberger, W. E. Donaldson, J. D. Garlich, E. W. Glazener, P. B. Hamilton, J. R. Harris, R. W. Harvey, C. H. Hill, W. L. Johnson, J. R. Jones, C. A. Lassiter, J. G. Lecce, R. D. Mochrie, R. M. Myers, F. D. Sargent, J. C. Wilk, G. H. Wise; ***Associate Professors:*** D. K. Carver, V. Fellner, G. B. Huntington, J. Luginbuhl, J. A. Moore, P. E. Mozdziak, E. van Heugten, C. S. Whisnant; ***Adjunct Associate Professors:*** R. J. Harrell, C. E. Whitfill; ***Associate Professors Emeriti:*** E. U. Dillard, J. J. McNeill; ***Assistant Professors:*** C. M. Ashwell, M. S. Ashwell, J. P. Cassady, M. E. Hockett, M. Koci, H. Liu; ***Adjunct Assistant Professors:*** C. L. Heggen-Peay, T. F. Middleton, C. J. Williams

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: G. W. Almond, D. K. Larick, J. Piedrahita, D. P. Wages; ***Professors (USDA):*** J. C. Burns; ***Associate Professors:*** G. A. Benson, M. D. Whitacre

Doctoral Degree Requirements: A doctoral degree in Animal Science and Poultry Science with a concentration in either Animal Science or Poultry Science is offered. Specific course requirements are flexible and each student's program of study is developed in consultation with their Ph.D. advisory committee. The minor is optional but external faculty representation is required on the advisory committee.

Note: The Master's program in Animal Science and Poultry Science are administered independently by each department.

Admission Requirements: Factors considered for admission include: grade point average, scores on the GRE, undergraduate courses, and letters of recommendation. A member of either the Animal Science Department or Poultry Science Department faculty can serve as the applicant's advisor.

Student Financial Support: The Departments of Animal Science and Poultry Science offer a limited number of research and teaching assistantships that are awarded on a competitive basis. Students may also be supported by research grant funds awarded to faculty members. Students applying for these assistantships are advised to

apply by February 15 for fall admission.

Other Relevant Information: There are two curriculum codes for the Animal Science and Poultry Science doctoral degree program. If a student is interested in a program concentration in Animal Science the appropriate curriculum code for the admissions application is ANA. If the student is interested in a program concentration in Poultry Science the appropriate curriculum code for the admissions application is ANP. If the appropriate curriculum code is not selected, it will likely delay the department's receipt of the applicant's information from the Graduate School.

GRADUATE COURSES

ANS 500 Advanced Ruminant Nutrition
ANS(NTR) 516 Animal Nutrition Research Methods
ANS 520 International Livestock Production
ANS 530 Advanced Applied Animal Reproduction
ANS 531 Advanced Applied Animal Reproduction Lab
ANS(NTR) 550 Applied Ruminant Nutrition
ANS 553 Growth and Development of Domestic Animals
ANS(FS, NTR) 554 Lactation and Milk Consumption
ANS(BCH) 571 Regulation of Metabolism
ANS 590 Special Topics
ANS 601/801 Animal Science Seminar
ANS(CBS,PHY,ZO) 602 Seminar in Biology of Reproduction
ANS 603 Reproductive Physiology Seminar
ANS 604 Animal Breeding and Genetics Seminar
ANS 610 Special Topics
ANS 641 Practicum in Animal Science
ANS(PHY) 702 Reproductive Physiology of Mammals
ANS 706 Mammalian Embryo Manipulation
ANS(GN) 708 Genetics of Animal Improvement
ANS(NTR) 709 Energy Metabolism
ANS 710 Advanced Livestock Management
ANS(GN) 713 Quantitative Genetics and Breeding
ANS(CBS,NTR,PHY) 764 Advances in Gastrointestinal Pathophysiology
ANS(NTR,PO) 775 Mineral Metabolism
ANS(PHY) 780 Mammalian Endocrinology
ANS(NTR) 785 Digestion and Metabolism in Ruminants
ANS 790 Advanced Special Topics
ANS 801 Animal Science Seminar
ANS(CBS,PHY,ZO) 802 Seminar in Biology of Reproduction
ANS 803 Reproductive Physiology Seminar
ANS 804 Animal Breeding and Genetics Seminar
ANS 810 Special Topics
ANS 841 Practicum in Animal Science
ANS 885 Doctoral Supervised Teaching
ANS 890 Doctoral Preliminary Examination
ANS 893 Doctoral Supervised Research
ANS 895 Doctoral Dissertation Research
ANS 896 Summer Dissertation Research
ANS 899 Doctoral Dissertation Preparation
PO 505 Physiological Aspects of Poultry Management
PO 524 Comparative Endocrinology
PO(BIT) 566 Animal Cell Culture Techniques
PO 590 Special Problems in Poultry Science
PO 601 Seminar
PO 620 Special Problems
PO 702 Biotechniques in Avian Biology
PO(CBS,IMM,PHY) 756 Immunogenetics
PO(IMM) 757 Avian Immunology
PO(ANS,NTR) 775 Mineral Metabolism
PO 801 Seminar
PO 820 Special Problems

PO 885 Doctoral Supervised Teaching
PO 893 Doctoral Supervised Research
PO 895 Doctoral Dissertation Research
PO 896 Summer Dissertation Research
PO 899 Doctoral Dissertation Preparation.

NCSU Graduate Catalog

Anthropology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Anthropology				Y			

GRADUATE FACULTY

Director of Graduate Programs:
A. L. Schiller, Box 8107, 515.9015, anne_schiller@ncsu.edu, Sociology & Anthropology

Professors: A. L. Schiller; ***Associate Professors:*** A. H. Ross, J. M. Wallace III; ***Assistant Professors:*** D. T. Case, R. S. Ellovich, S. M. Fitzpatrick, J. K. Jacka

The graduate degree in Anthropology is a 36-hour, two-year long Master of Arts thesis program which will enable students to gain a deeper understanding of the behavior, beliefs, and evolutionary legacy of the human species. In addition to common core courses, students select one of three concentrations in which to focus their studies: Bioarchaeology, Cultural Anthropology, or Environmental Anthropology.

The program provides excellent preparation for students wishing to pursue a Ph.D. in Anthropology. Graduates of the program may also pursue employment in a variety of areas including development organizations and non-profits, human resource management, cultural resource management, or in physical anthropology or archeology labs.

Admissions Requirements: In addition to general Graduate School requirements, applicants are required to provide a completed application, including transcripts, GRE scores, three letters of recommendation, and a personal statement. A writing sample and CV are optional but encouraged. The deadline for completed applications is January 15. The curriculum is set for fall admission only.

Master's Degree Requirements: The M.A. degree requires a total of 36 credit hours. All students take six hours of common core courses in theory and qualitative research and then select one of the three specializations: cultural anthropology, environmental anthropology, or bioarcheaology. Students in all three concentrations will take six hours of thesis research credit (ANT 695).

Student Financial Support: Teaching assistantships are available on a competitive basis. Students are appointed to assistantships with the expectation of reappointment, assuming normal progress, for a total period of two years.

GRADUATE COURSES

ANT 508 Culture and Personality
ANT 511 Overview of Anthropological Theory
ANT 512 Applied Anthropology
ANT 516 Qualitative Research Methods
ANT 521 Human Osteology
ANT 533 Anthropology of Ecotourism and Heritage Conservation
ANT 544 Cross-Cultural Perspective on Women
ANT 550 Environmental Anthropology
ANT 560 Urban Anthropology
ANT 564 Anthropology of Religion
ANT 575 Environmental Archaeology
ANT 585 Skeletal Biology in Anthropology
ANT 595 Special Topics in Anthropology

ANT 610 Special Topics in Anthropology
ANT 693 Master's Supervised Research
ANT 695 Master's Thesis Research
ANT 696 Summer Thesis Research
ANT 699 Master's Thesis Preparation
ANT 810 Special Topics in Anthropology

NCSU Graduate Catalog

Architecture

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Architecture					Y		

GRADUATE FACULTY

P. Tesar, ***Director of the School of Architecture***

Director of Graduate Programs:
W. H. Redfield, Box 7701, 515.8362, wendy_redfield@ncsu.edu, Architecture

Alumni Distinghuished Professor of Architecture: P. Tesar
Alumni Distinguished Professor of Architecture and Director of Graduate Program: J. P. Rand
Graduate Alumni Distinguished Professor of Architecture: R. H. Clark
Professor of Architecture: J. W. Place

Professors: T. M. Barrie, G. Bizios, M. J. Malecha; ***Professors Emeriti:*** P. Batchelor, F. A. Rifki; ***Associate Professors:*** W. H. Redfield, K. Schaffer, J. O. Tector; ***Associate Professors Emeriti:*** D. W. Barnes Jr.; ***Assistant Professors:*** P. Battaglia, L. Garofalo, D. B. Hill; ***Visiting Assistant Professors:*** R. S. Lanou, F. Wang

The School of Architecture offers three tracks to the Master of Architecture degree: Track 1 is for applicants with a four-year undergraduate pre-professional degree in architecture and may be completed in two years of full-time study. Track 2 is for applicants holding a five-year NAAB-accredited Bachelor of Architecture degree and normally requires three semesters in residence. Track 3 is for students with degrees in fields other than architecture. This track normally requires three semesters of preparatory work before entering the final two-year program of graduate study. Some applicants with design-related academic or professional experience may be able to complete the preparatory work in less time.

A variety of courses are available within the School of Architecture in urban and community design, architectural history and theory, material fabrication, professional practice, building technology and environmental systems.

Admission Requirements: In addition to documents required by the Graduate School, students apply to the Master of Architecture program by submitting the following documents by January 5: (1) Portfolio of work; (2) Completed School Personal Data Form; (3) GRE scores (Track 3 applicants only); (4) TOEFL scores (foreign language students only). Applicants will be considered on an individual basis. Exceptions to Graduate School policy may be made for students indicating other qualifications and professional experience.

Master's Degree Requirements: The school stipulates the minimum course credits based on educational and professional goals to individualize a plan of study.

Student Financial Support: The school awards a number of scholarships, awards, and teaching assistantships competitively. It also supports national and statewide scholarships, fellowships, and awards. All support is merit based, not need based. No special application for such support is necessary at the time of admissions.

National Architectural Accrediting Board (NAAB): "In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of

Architecture, and the Doctor of Architecture. A program may be granted a six-year, three-year, or two-year term of accreditation, depending on its degree of conformance with established educational standards.

"Master's degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, comprise an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

"Professional degree programs in the NC State University School of Architecture (i.e. Master of Architecture and Bachelor of Architecture) are fully accredited by the NAAB. The Bachelor of Environmental Design in Architecture (BEDA) degree, being a pre-professional program, does not fall under NAAB accreditation jurisdiction although it serves as the foundation for the two accredited professional degrees."

GRADUATE COURSES

ARC 500 Architectural Design: Professional Studio
ARC 503 Advanced Architectural Design (Series)
ARC 511 Mapping the Modern Site
ARC 530 Tectonics and Craft
ARC 532 Contemporary Processes in Architecture
ARC 533 Materials for Architecture: Advanced Materials and Emerging Technologies
ARC 543 Analysis of Precedent
ARC 544 Architectural Conservation
ARC 545 Contemporary Architecture Theory and Criticism
ARC 546 Theory of Building Types
ARC 548 Vernacular Architecture
ARC 551 Design Methods and Programming
ARC 561 The Practice of Architecture
ARC 562 Legal Issues in Architecture
ARC 570 Anatomy of the City
ARC 571 The Urban House
ARC 573 Environmental Perception
ARC 574 Place and Place Making
ARC 575 Participatory Design in Architecture
ARC 576 (DDN 776, LAR 576) Community Design
ARC 577 (DDN 777, LAR 577) Sustainable Communities
ARC 578 (DDN778, LAR578) Ecological Design
ARC 581 Project Preparation Seminar
ARC 589 Architectural Travel Study II
ARC 590 Special Topics
ARC 598 Final Project Studio in Architecture
ARC 630 Independent Study
ARC 676 Special Project
ARC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ARC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ARC 697 Final Research Project

NCSU Graduate Catalog

Art And Design

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Art and Design					Y		

GRADUATE FACULTY

C. D. Cox, ***Department Chair***

Director of Graduate Programs:
S. D. Brandeis, Box 7701, 515.3876, susan_brandeis@ncsu.edu, Art and Design

Professors: S. D. Brandeis, C. E. Joyner, M. Pause; ***Associate Professors:*** C. D. Cox, L. M. Diaz, P. FitzGerald, V. K. Plume, D. G. Raymond, K. Rieder, S. M. Toplikar; ***Visiting Assistant Professors:*** R. W. DeWitt, T. A. Krumm

The Art and Design program offers an educational structure that creates a new art and design professional: one for whom artistic and practical talents are developed as different expressions of individual potential. Our objectives are to graduate highly educated art and design professionals with integrated competencies in art, design, aesthetics, hand and digital technologies, skills in the concentration and other disciplines of human knowledge.

Areas of concentration in the Master of Art and Design are (1) Fibers and Surface Design, and (2) Animation and New Media.

Admission Requirements: Students will be required to submit a portfolio of past work in slide or electronic format; three letters of recommendation; a statement of personal goals; and transcripts of undergraduate work (minimum undergraduate GPA of 3.0). An interview will be required, but in cases of international applicants or those quite distant from NC State University, may be conducted by means of a long distance phone conversation or may be waived at the faculty's discretion.

Master's Degree Requirements: The program of study requires a minimum of 48 credit hours of graduate work depending on background preparation of the applicant. Separate tracks of 60 and 72 credit hours accommodate students with insufficient background in the chosen concentration.

Other Information: We will only admit students to the program in the fall semester each year. Deadline for application is January 5.

GRADUATE COURSES

ADN 503 Graduate Seminar in Art and Design
ADN 560 Advanced Animation Studio
ADN 561 Digital Animation and Imaging Seminar
ADN 570 Advanced Fibers and Surface Design Studio
ADN 571 Fibers and Surface Design Seminar
ADN 575 Pre-Industrial World Textiles
ADN 581 Final Project Research
ADN 588 Final Project Studio
ADN 592 Special Topics in Art and Design
ADN 630 Independent Study in Art and Design
ADN 688 Non-Thesis Master's Continuous Registration - Half-Time Registration

ADN 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

NCSU Graduate Catalog

Biological and Agricultural Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Biological and Agricultural Engineering	Y		Y		Y		

GRADUATE FACULTY

R. O. Evans Jr., ***Department Head***

Director of Graduate Programs:
D. H. Willits, Box 7625, 515.6755, dan_willits@ncsu.edu, Biological & Agricultural Engineering

Distinguished University, Graduate Alumni Distinguished, and Wm. Neal Reynolds Professor: R. W. Skaggs

Professors: D. B. Beasley, M. D. Boyette, R. O. Evans Jr., S. A. Hale, G. D. Jennings, T. M. Losordo, R. S. Sowell, J. Spooner, L. F. Stikeleather, P. W. Westerman, D. H. Willits; ***Professors (USDA):*** T. B. Whitaker; ***Adjunct Professors:*** L. M. Safley, L. M. Sykes; ***Professors Emeriti:*** C. F. Abrams Jr., J. C. Barker, C. G. Bowers Jr., J. W. Dickens, L. B. Driggers, E. G. Humphries, W. H. Johnson, G. J. Kriz, W. F. McClure, F. M. Richardson, R. P. Rohrbach, A. R. Rubin, R. E. Sneed, C. W. Suggs, E. H. Wiser, J. H. Young; ***Associate Professors:*** G. R. Baughman, J. Cheng, J. J. Classen, R. L. Huffman, G. T. Roberson; ***Assistant Professors:*** M. Burchell III, M. S. Chin, G. L. Grabow, W. F. Hunt III, P. L. Mente, S. Shah, R. Sharma, M. W. Veal, L. Wang, M. Youssef; ***Research Assistant Professors:*** G. M. Chescheir; ***Adjunct Assistant Professors:*** D. M. Amatya

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: K. R. Swartzel, B. E. Farkas, A. E. Hassan; ***Associate Professors:*** C. R. Daubert, S. C. Roe, K. P. Sandeep

Course offerings or research facilities are available in the following areas: bioinstrumentation, biomechanics, bioprocessing, food and process engineering, biological systems modeling, aquaculture, hydrology, water table management, ground water management, animal waste management, non-point source pollution, power and machinery, soil and water, controlled environment agriculture, electrical and electronic systems, robotics and machine vision.

Admission Requirements: A baccalaureate in biological or agricultural engineering or the equivalent is the preferred prerequisite for admission. Those with strong academic background in the physical or biological sciences may also be admissible with a requirement for certain additional background undergraduate work. In the case of applicants with Master's degrees, a Master's GPA of at least 3.2 is required for admission. Exceptions to the overall undergraduate GPA requirements may be made for cases where performance in the major or during the last two years was at or above the 3.00 level.

GRE scores are recommended for those with academic performance records near the minimal level. Applicants without engineering degrees from domestic accredited institutions must submit GRE scores to be considered for admission. Admission decisions are made by a faculty review committee. The best-qualified applicants will be accepted up to the number of spaces available for new students.

Master's Degree Requirements
M.BAE: This Option B non-thesis degree requires 30 hours of approved graduate course work. This degree is available via Distance Education.
M.S.: This is a thesis degree requiring 30 hours of approved graduate coursework. A minor is required.

Doctoral Degree Requirements: Course hour requirements are flexible but typically include at least 36 hours beyond a Master's degree. Direct admission without a Master's is possible in exceptional cases. A minor is required.

Student Financial Support: Graduate assistantships are available to students in this program on a competitive basis.

GRADUATE COURSES

BAE 501 Instrumentation for Biological Systems
BAE 502 Instrumentation for Hydrologic Applications
BAE 525 Industrial Microbiology and Bioprocessing
BAE 535 Precision Agriculture Technology
BAE 570 Soil Water Movement
BAE 572 Irrigation and Drainage
BAE(SSC) 573 Hydrologic and Water Quality Modeling
BAE 575 Design of Structural Stormwater Best Management Practices
BAE 576 Watershed Monitoring and Assessment
BAE 577 Introduction to the Total Maximum Daily Load Program
BAE(CE) 578 Agricultural Waste Management
BAE 579 Stream Channel Assessment and Restoration
BAE 590 Special Topics in Biological and Agricultural Engineering
BAE 601 Seminar
BAE 610 Special Topics
BAE 620 Special Problems
BAE 685 Master's Supervised Teaching
BAE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
BAE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
BAE 690 Master's Examination
BAE 693 Master's Supervised Research
BAE 695 Master's Thesis Research
BAE 696 Summer Thesis Research
BAE 699 Master's Thesis Preparation
BAE(SSC) 771 Theory of Drainage--Saturated Flow
BAE(SSC) 774 Theory of Drainage--Unsaturated Flow
BAE(SSC) 780 Transport and Fate of Chemicals in Soils and Natural Waters
BAE(FS) 785 Food Rheology
BAE 790 Special Topics in Biological and Agricultural Engineering
BAE 801 Seminar
BAE 810 Special Topics
BAE 820 Special Problems
BAE 885 Doctoral Supervised Teaching
BAE 890 Doctoral Preliminary Examination
BAE 893 Doctoral Supervised Research
BAE 895 Doctoral Dissertation Research
BAE 896 Summer Dissertation Research
BAE 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Biochemistry

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Biochemistry	Y		Y		Y		

GRADUATE FACULTY

D. T. Brown, ***Department Head***

Director of Graduate Programs:
E. S. Maxwell, Box 7622, 515.5803, stu_maxwell@ncsu.edu, Biochemistry

William Neal Reynolds Professor: L. K. Hanley-Bowdoin, W. L. Miller

Professors: P. F. Agris, D. T. Brown, J. Cavanagh, C. L. Hemenway, E. S. Maxwell, E. C. Sisler, P. L. Wollenzien; ***Adjunct Professors:*** K. S. Korach, J. D. Otvos, E. C. Theil; ***Professors Emeriti:*** F. B. Armstrong, H. R. Horton, J. S. Kahn, I. S. Longmuir; ***Associate Professors:*** A. C. Clark, C. C. Hardin, J. A. Knopp, C. Mattos; ***Assistant Professors:*** M. B. Goshe, R. B. Rose; ***Adjunct Assistant Professors:*** R. E. Cannon

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: R. R. Sederoff, H. M. Hassan, J. W. Moyer; ***Named Professors Emeriti:*** H. E. Swaisgood; ***Associate Professors:*** J. W. Brown, J. M. Horowitz; ***Assistant Professors:*** K. R. Weninger

The graduate program in biochemistry is designed to prepare individuals for careers in research and teaching. Emphasis is primarily focused on laboratory research, where graduate students work closely with faculty. The department is well equipped to conduct research in biochemistry, biophysics, molecular biology and molecular genetics.

Admission Requirements: Students entering the graduate program in biochemistry should have a bachelor's degree in biochemistry, chemistry or a related physical or biological science, including undergraduate courses in organic chemistry, calculus, physics and physical chemistry, as well as biochemistry/molecular biology.

Master of Science Degree Requirements: The Master of Science degree requires a minimum of 30 credit hours of courses and thesis research including nine credit hours in biochemistry graduate core courses. On average, completion of the M.S. degree requires two to three years.

Doctoral Degree Requirements: Requirements for the Ph.D. degree include a minimum of 30 credit hours in course work and thesis research, including the three graduate core courses and at least two advanced courses in biochemistry/ molecular biology; teaching experience. Formal course work may be completed within three semesters; on average, completion of the Ph.D. degree requires five years.

Student Financial Support: The department endeavors to meet the financial needs of students accepted into its doctoral program. Essentially all admitted students are offered the opportunity to apply for graduate teaching and research assistantships.

Other Relevant Information: The Department of Biochemistry is jointly administered by the Colleges of Agriculture and Life Sciences and Physical and Mathematical Sciences. The department, committed to a strong research environment, interacts with other life science departments on campus as well with the other research universities and institutes of the Research Triangle area.

GRADUATE COURSES

BCH 552 Experimental Biochemistry
BCH 553 Biochemistry of Gene Expression
BCH 555 Proteins and Molecular Mechanisms
BCH(ANS) 571 Regulation of Metabolism
BCH 601 Seminar
BCH 610 Special Topics
BCH 615 Advanced Special Topics
BCH(TOX) 660 Free Radicals in Toxicology
BCH 670 Laboratory Rotations
BCH 685 Master's Supervised Teaching
BCH 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
BCH 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
BCH 690 Master's Examination
BCH 693 Master's Supervised Research
BCH 695 Master's Thesis Research
BCH 696 Summer Thesis Research
BCH 699 Master's Thesis Preparation
BCH 701 Macromolecular Structure
BCH 703 Macromolecular Synthesis and Regulation
BCH 705 Molecular Biology of the Cell
BCH 751 Biophysical Chemistry
BCH(GN) 761 Advanced Molecular Biology of the Cell
BCH 763 Biochemistry of Hormone Action
BCH(GN) 768 Nucleic Acids: Structure and Function
BCH 801 Seminar
BCH 810 Special Topics
BCH 815 Advanced Special Topics
BCH(TOX) 860 Free Radicals in Toxicology
BCH 870 Laboratory Rotations
BCH 885 Doctoral Supervised Teaching
BCH 890 Doctoral Preliminary Examination
BCH 893 Doctoral Supervised Research
BCH 895 Doctoral Dissertation Research
BCH 896 Summer Dissertation Research
BCH 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Biomathematics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Biomathematics	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
A. L. Lloyd, Box 8203, 515.1910, alun_lloyd@ncsu.edu, Statistics

Burroughs Wellcome Distinguished Professor: J. E. Riviere
Camille Dreyfus Professor: C. K. Hall
University Professor and Drexel Professor: H. T. Banks
William Neal Reynolds Distinguished Professor: W. R. Atchley
William Neal Reynolds Professor: Z. Zeng

Professors: J. F. Gilliam, K. H. Pollock, J. F. Selgrade, R. E. Stinner, J. L. Thorne, H. T. Tran, G. G. Wilkerson; ***Professors Emeriti:*** J. W. Bishir, H. E. Schaffer; ***Associate Professors:*** N. M. Haddad, M. A. Haider, G. R. Hess, A. L. Lloyd, S. R. Lubkin, S. V. Muse, C. E. Smith; ***Assistant Professors:*** K. Gross, M. Olufsen

ASSOCIATE MEMBERS OF THE PROGRAM

Adjunct Professors: R. B. Conolly, L. B. Crowder, P. H. Morgan; ***Adjunct Associate Professors:*** J. M. Hoenig; ***Adjunct Assistant Professors:*** G. Bobashev, J. S. Kimbell, M. W. Lutz

Biomathematics is an interdisciplinary graduate program offering courses and research opportunities in basic and applied mathematical biology. Degree programs are flexible to accommodate students with backgrounds in the biological, mathematical or physical sciences. The program also offers Ph.D. and master's-level minors. A brochure with additional information on requirements, courses, faculty and current research can be obtained by writing the program director.

Admission Requirements: Applicants should have either a Bachelor's degree in biology with evidence of aptitude and interest in mathematics, or a bachelor's in a mathematical science with evidence of aptitude and interest in biology. Advanced (multivariate) calculus, linear algebra and general biology are prerequisites for all BMA courses, and deficiencies in these should be remedied during the first year of graduate study. The application must include a narrative statement (1-2 pages) of the applicant's goals and reasons for interest in the BMA program.

Master's Degree Requirements: The M.S. and M.BMA. degrees require BMA 771-772 and one other BMA course; two upper-level biology courses; and three courses from the mathematical sciences or statistical sciences. The M.S. degree requires a thesis, and the M.BMA. requires two additional courses and a written project.

Doctoral Degree Requirements: Course requirements consist of a "core" and a "concentration" in some area of biology or mathematical sciences. Core requirements are: BMA 771-772, 773 and 774; three upper-level biology courses from at least two areas (e.g., physiology and evolution); and additional courses from the mathematical or statistical sciences. Concentration consists of either a Ph.D. co-major in a biological or mathematical science or a coherent series of five graduate courses approved by the student's committee, which must include a two-semester sequence and at least one 700-level course.

Financial Assistance: TAs (generally in the Departments of Statistics or Mathematics), RAs and internships are available. Awards are based on GRE scores, transcripts and letters of recommendation. RAs usually are held by continuing students. To receive full consideration for financial aid, the completed application must be received by January 15.

Other Relevant Information: All students are required to participate in the BMA Graduate Seminar. Course requirements can be met by examination or by demonstrating that an equivalent course was completed at another university.

GRADUATE COURSES

BMA 567 Modeling of Biological Systems
BMA 573 Mathematical and Experimental Modeling of Physical Processes I
BMA 574 Mathematical and Experimental Modeling of Physical Processes II
BMA 590 Special Topics
BMA 610 Special Topics
BMA 685 Master's Supervised Teaching
BMA 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
BMA 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
BMA 690 Master's Examination
BMA 693 Master's Supervised Research
BMA 695 Master's Thesis Research
BMA 696 Summer Thesis Research
BMA 699 Master's Thesis Preparation
BMA(OR,ST) 722 Decision Analytic Modeling
BMA(MA,ST) 771 Biomathematics I
BMA(MA,ST) 772 Biomathematics II
BMA(MA,OR,ST) 773 Stochastic Modeling
BMA(MA,OR) 774 Partial Differential Equation Modeling in Biology
BMA 790 Special Topics
BMA 801 Seminar
BMA 815 Advanced Special Topics
BMA 885 Doctoral Supervised Teaching
BMA 890 Doctoral Preliminary Examination
BMA 893 Doctoral Supervised Research
BMA 895 Doctoral Dissertation Research
BMA 896 Summer Dissertation Research
BMA 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Biomedical Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Biomedical Engineering	Y		Y				

GRADUATE FACULTY

H. T. Nagle Jr., ***Interim Department Head***

Director of Graduate Programs:
S. B. Knisley, Box 7115, 966.6653, sknisley@email.unc.edu, Biomedical Engineering

Professors: E. Grant, H. T. Nagle Jr.; ***Adjunct Professors:*** A. J. Banes, S. L. Cooper, H. Hsiao, S. B. Knisley, W. Lin, C. N. Lucas, B. J. Oberhardt, E. D. Pisano; ***Professors Emeriti:*** C. F. Abrams Jr.; ***Associate Professors:*** L. Cartee, M. G. McCord, H. O. Ozturk; ***Adjunct Associate Professors:*** R. G. Dennis, O. V. Favorov, C. C. Finley, R. J. Narayan, S. R. Quint, M. A. Tommerdahl, P. S. Weinhold; ***Assistant Professors:*** D. S. Lalush, E. G. Loboa, G. S. McCarty, P. L. Mente, B. N. Steele, G. M. Walker; ***Adjunct Assistant Professors:*** C. M. Gallippi, R. L. Goldberg, S. M. Gomez, J. M. MacDonald

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: D. L. Bitzer, B. Pourdeyhimi, A. E. Tonelli, N. S. Allen, M. A. Bourham, J. Cavanagh, M. Chow, R. P. Gardner, R. M. Grossfeld, S. A. Hale, C. Kleinstreuer, H. Krim, N. A. Monteiro-Riviere, S. A. Rajala, W. E. Snyder, L. F. Stikeleather, M. K. Stoskopf, M. A. V. Vouk; ***Research Professors:*** W. C. Holton; ***Associate Professors:*** G. D. Buckner, D. R. Cormier, M. A. Haider, A. V. Kuznetsov, G. Lazzi, S. R. Lubkin, J. F. Muth, A. Rabiei, M. K. Ramasubramanian, S. C. Roe, S. Seelecke, C. E. Smith, A. M. Stomp; ***Assistant Professors:*** M. Ghovanloo, O. Harrysson, M. Olufsen

The Joint Biomedical Engineering Graduate Program is administered by the combined biomedical engineering graduate faculty from both NC State University and University of North Carolina at Chapel Hill. The joint program also has close working relations with the Research Triangle Institute and industry within the Research Triangle area. These associations enable students to obtain research training in a wide variety of fields and facilitate the selection and performance of dissertation research. The department, thus, provides students with excellent opportunities to realize the goal of enhancing medical care through the application of modern technology.

Biomedical engineering is a dynamic field stressing the application of engineering techniques and mathematical analysis to biomedical problems. . Faculty research programs are key to the program, and they include digital systems and signal processing, instrumentation, telemedicine, microelectronics, medical imaging, biofluids and biomechanics, biomaterials and tissue engineering, biosystems analysis, biomedical informatics. Facilities include a biomedical sensors laboratory, a tissue engineering laboratory, tissue and cell mechanics laboratories, and an array of cell culturing and computing resources.

Admission Requirements: Students must satisfy all entrance requirements for the Graduate Schools of the University of North Carolina at Chapel Hill or North Carolina State University and must demonstrate interest and capability commensurate with the quality of the biomedical engineering program. Prospective students may apply to the graduate school at either UNC-CH or NC State. All applicants are considered together as a group and there is no advantage in applying at one institution or the other. Generally, applications should be submitted by January 1 for consideration for admission in the coming fall semester. Applicants are expected to present GRE scores; scores for verbal and quantitative should be at or above the 50^{th} percentile to be competitive. The

program requires that a one-to-three page personal statement about research interest and background be submitted.

Master's Degree Requirements: For students with a strong engineering background a minimum of 31 semester hours of graduate study is required for the M.S. Degree. Three hours must be in thesis and three hours must be in a course intended for graduate students only (the 700 level at NC State or the 700-800 level at UNC-CH). Further information on the BME Master's program can be found on the department website.

Doctoral Degree Requirements: A minimum of 52 semester hours of graduate work is required (beyond the Bachelor's degree). The student must meet the Graduate School's residency requirement at UNC-CH or NC State as appropriate. All Ph.D. students are also required to have some teaching experience. Further information on the BME Ph.D. program can be found on the department website.

Required and highly recommended courses: Students are required to take Introduction to Biomedical Engineering Seminar (BMME 400) offered at both UNC-CH and NC State and at least one credit of research experience in the first year of study. Students must also complete nine credits of graduate engineering topics, eight credits of graduate life science topics, six credits of engineering mathematics, and three credits of statistics. Students may choose from a number of courses to meet these requirements. Such choices are made in consultation with the student's academic advisor and the Director of Graduate Programs/Studies.

Comprehensive and Qualifying Examinations: Master's students are required to take a Comprehensive examination, encompassing coursework and thesis research. The Master's Comprehensive exam may be either written or oral, and is administered by the students advisory committee. Doctoral students qualify for the PhD degree by meeting grade requirements in their core courses, and then advance on to written and oral preliminary exams before admission to candidacy. Details can be found on the department website.

GRADUATE COURSES

BME 512 Biomedical Signal Processing
BME(ECE) 522 Medical Instrumentation
BME 525 Bioelectricity
BME 541 Biomechanics
BME 550 Medical Imaging: Ultrasonic, Optical, and Magnetic Resonance
BME 560 Medical Imaging: X-ray, CT, and Nuclear Medicine Systems
BME 590 Special Topics in Biomedical Engineering
BME 601 Seminar in Biomedical Engineering
BME 620 Special Problems in Biomedical Engineering
BME 650 Internship in Biomedical Engineering
BME 685 Master's Supervised Teaching
BME 693 Master's Supervised Research
BME 695 Master's Thesis Research
BME 696 Summer Thesis Research
BME 699 Master's Thesis Preparation
BME 790 Advanced Special Topics in Biomedical Engineering
BME 802 Advanced Seminar in Biomedical Engineering
BME 885 Doctoral Supervised Teaching
BME 890 Doctoral Preliminary Examination
BME 893 Doctoral Supervised Research
BME 895 Doctoral Dissertation Research
BME 896 Summer Dissertation Research
BME 899 Doctoral Dissertation Preparation

For UNC courses, see also http://www.bme.ncsu.edu/academics/syllabi.php

NCSU Graduate Catalog

Business Management

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Business Administration					Y		

GRADUATE FACULTY

S. H. Barr, ***Department Head***

Director of Graduate Programs:
S. G. Allen, Box 7229, 515.5584, steve_allen@ncsu.edu, Business Management

Alan T. Dickson Distinguished University Professor: M. A. Rappa
Bank of America University Distinguished Professor: R. B. Handfield

Professors: S. G. Allen, S. H. Barr, J. W. Bartley, Y. A. Chen, R. L. Clark, D. M. Holthausen Jr., C. P. Jones, A. I. Kingon, R. Kouri, S. E. Margolis, M. Montoya-Weiss, I. R. Weiss; ***Professors Emeriti:*** J. R. Canada, G. W. Dickson, J. W. Wilson; ***Associate Professors:*** L. Aiman-Smith, D. L. Baumer, C. C. Bozarth, S. N. Chapman, K. S. Davis, J. C. Dutton Jr., J. B. Earp, S. K. Markham, J. K. McCreery, K. Mitchell, P. W. Mulvey, C. M. Newmark, A. Padilla, J. C. Poindexter Jr., B. B. Tyler, G. S. Young; ***Associate Professors Emeriti:*** C. W. Harrell Jr., E. A. McDermed; ***Assistant Professors:*** E. A. Baker, J. Barnes, P. K. Bergey, T. Caner, B. Danielsen, D. H. Henard, T. Hollmann, W. Kang, S. Moon, T. O'Driscoll, F. C. Payton, C. Rossetti, S. Schanz, D. Sirdeshmukh, M. D. Walker, R. S. Warr, D. Warsing, J. Zhao

ASSOCIATE MEMBERS OF THE PROGRAM

Associate Professors: P. Arasu

The Master of Business Administration (MBA) program develops leaders for tomorrow's markets and technologies. NC State's MBA provides a solid foundation in the principles of finance, marketing, and other traditional business subjects.

The most distinctive feature of the program is its emphasis on management of technology. We offer concentrations in Biotech/Pharmaceuticals Management, Financial Management, Information Technology Management, Marketing Management, Product Innovation Management, Services Management, Supply Chain Management, and Technology Entrepreneurship. Most students have a technology background, either from their undergraduate degree or previous work experience.

Admission Requirements: In addition to basic Graduate School admission requirements, applicants must submit recent GMAT scores. Admission decisions are based on academic performance and potential, GMAT scores, essays, and relevant work experience. Students must have a previous coursework in calculus before entering the program. For further information, please visit the MBA website at www.mba.ncsu.edu.

Master's of Business Administration: The MBA curriculum requires that every student complete the core curriculum listed below, along with concentration and elective courses, for a total of 51 credit hours for full-time students and 45 credit hours for part-time students.

ACC 580 Survey of Accounting
BUS 500 Strategic Management
BUS 520 Managerial Finance

BUS 530 Managing People in the High Tech Environment
BUS 550 Data Analysis and Forecasting Methods for Management
BUS 560 Marketing Management and Strategy
BUS 570 Production and Operations Management
BUS 590T Managerial and Career Effectiveness
ECG 507 Economics for Managers

Technical Concentration: Minimum of 12 hours (full-time) or nine (9) hours (part-time) of courses in one of the following areas: Biotech/Pharmaceuticals Management, Financial Management, Information Technology Management, Marketing Management, Product Innovation Management, Services Management, Supply Chain Management, and Technology Entrepreneurship

Electives: Minimum of 12 hours for full-time students, three (3) hours of which must be in a course in information technology management and three (3) hours of which must be in a global elective course. Minimum of nine (9) hours for part-time students, three (3) hours of which must be in a global elective course.

Minor in Management: Students enrolled in Master's and doctoral programs can complete the minor by taking courses that meet requirements for the MBA degree. Master's students must take nine (9) hours; doctoral students must take 15 hours.

GRADUATE COURSES

BUS 500 Strategic Management
BUS 501 Legal and Regulatory Environment in Management
BUS 504 Technology, Law and the Internet
BUS 510 Managing the Digital Enterprise
BUS 511 Networking Infrastructure for E-commerce
BUS(CSC) 516 E-Commerce Practicum
BUS 520 Managerial Finance
BUS 522 Portfolio and Capital Market Theory
BUS 524 Financial Markets and Institutions
BUS 526 International Finance
BUS 527 Corporate Risk Management with Derivatives
BUS 528 Short-term Capital Management
BUS 529 New Firm Financing
BUS 530 Managing People in the High-Tech Environment
BUS 532 Strategic Human Resource Management
BUS 533 Leadership in Management
BUS 540 Information Technology for Managers
BUS 541 Strategic Information Technology
BUS 543 DataBase Management
BUS 545 Management Support Systems
BUS 546 Analysis and Design of Management Support Systems
BUS 547 Management Support Systems Project
BUS 549 Managerial Issues in Information Systems
BUS 550 Data Analysis and Forecasting Methods for Management
BUS 560 Marketing Management and Strategy
BUS 562 Research Methods in Marketing
BUS 564 Project Management
BUS 565 Product Design and Development
BUS 570 Production and Operations Management
BUS 572 Planning and Control Systems
BUS 573 Supply Chain Management
BUS 574 Management of Technology
BUS(MSE) 576 Technology Evaluation and Commercialization Concepts
BUS(MSE) 577 High Technology Entrepreneurship
BUS(MSE) 578 Implementing Technology Commercialization Strategies
BUS 579 Entrepreneurship
BUS(TTM) 585 Market Research in Textiles
BUS 590 Special Topics in Business Management

BUS 630 Independent Study
BUS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
BUS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

NCSU Graduate Catalog

Chemical Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Chemical Engineering	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
S. A. Khan, Box 7905, 515.4519, khan@eos.ncsu.edu, Chemical Engineering

Hoechst Celanese Professor Emeritus: R. M. Felder
Alcoa Professor of Chemical Engineering: R. M. Kelly
Camille Dreyfus Professor: C. K. Hall, H. B. Hopfenberg
Distinguished University Professor: D. F. Ollis
Frank Hawkins Kenan Distinguished Professor of Chemical Engineering: R. G. Carbonell
W. H. Clark Distinguished Professor: K. E. Gubbins
William R. Kenan Jr. Distinguished Professor and Mary Ann Smith Professor: J. M. DeSimone

Professors: P. S. Fedkiw, J. Genzer, C. S. Grant, S. A. Khan, H. H. Lamb, P. K. Lim, M. R. Overcash, G. N. Parsons, R. J. Spontak; ***Adjunct Professors:*** A. L. Andrady, S. L. Cooper, D. J. Kiserow, J. J. Spivey; ***Professors Emeriti:*** W. R. Henderson, G. W. Roberts; ***Associate Professors:*** J. M. Haugh, S. W. Peretti, O. D. Velev; ***Associate Professors Emeriti:*** H. Winston; ***Assistant Professors:*** W. Henderson, B. Rao, J. H. van Zanten; ***Research Assistant Professors:*** K. Efimenko; ***Adjunct Assistant Professors:*** M. D. Burke, M. D. Dickey, J. P. Hinestroza

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: H. Jameel, B. Pourdeyhimi, C. M. Balik; ***Associate Professors:*** C. R. Daubert

Research activities in the department include: biomolecular engineering; catalysis, electrochemical and reaction engineering; electronic materials; green chemistry and engineering; polymers and colloids; nanotechnology and interfacial science; thermodynamics and molecular simulation; and supercritical fluids.

Admissions Requirements: Students admitted to the graduate program normally have a Bachelor's degree in chemical engineering or its equivalent. Students with undergraduate degrees in chemistry, physics or other engineering disciplines may be admitted but will be required to make up undergraduate course work deficiencies in chemical engineering without graduate credit. The most promising candidates will be accepted up to the number of spaces available.

Master of Science Degree Requirements: The M.S. degree requires a minimum of 30 credit hours. A set of four core courses is required. Two options are provided. In the thesis option, the final thesis must be defended in a final public oral examination. In the non-thesis option, the student must satisfactorily complete a total of 10 graduate courses.

Master of Chemical Engineering Degree Requirements: The M.Ch.E. degree requires a minimum of 30 credit hours. A set of four core courses is required. A three-credit project is also required.

Doctor of Philosophy Degree Requirements: Students normally take a set of five core courses, two advanced courses and at least 6 credits of dissertation research. A thesis is required; this must be defended in a final public oral examination. In addition, the candidate must: (1) submit and defend an original written proposition

in any area of chemical engineering, and (2) submit and defend a proposal to perform his/her thesis research.

GRADUATE COURSES

CHE 525 Process System Analysis and Control
CHE(OR) 527 Optimization of Engineering Processes
CHE 543 Polymer Science and Technology
CHE 546 Design and Analysis of Chemical Reactors
CHE 551 Biochemical Engineering
CHE 560 Chemical Processing of Electronic Materials
CHE(BIT) 563 Fermentation of Recombinant Microorganisms
CHE 565 Diffusion in Polymers
CHE 575 Advances in Pollution Prevention: Environmental Management
CHE 576 Life Cycle and Sustainability Concepts for the Environment
CHE(NE) 585 Management of Hazardous Chemical and Radioactive Wastes
CHE 596 Special Topics
CHE 597 Special Projects
CHE 601 Seminar
CHE 610 Special Topics
CHE 685 Master's Supervised Teaching
CHE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CHE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CHE 690 Master's Examination
CHE 693 Master's Supervised Research
CHE 695 Master's Thesis Research
CHE 696 Summer Thesis Research
CHE 699 Master's Thesis Preparation
CHE 711 Chemical Engineering Process Modeling
CHE 713 Thermodynamics I
CHE 714 Thermodynamics II
CHE 715 Transport Phenomena I
CHE 716 Transport Phenomena II
CHE 717 Chemical Reaction Engineering
CHE 718 Advanced Chemical Reaction Engineering
CHE 719 Electrochemical Systems Analysis
CHE 721 Separation Processes
CHE 752 Separation Processes for Biological Materials
CHE 760 Photochemical Engineering: Fundamentals and Applications
CHE(MSE) 761 Polymer Blends and Alloys
CHE(TC) 769 Polymers, Surfactants and Colloidal Materials
CHE 779 Diffusion in Polymers
CHE 796 Special Topics in Chemical Engineering
CHE 797 Chemical Engineering Projects
CHE 798 Advanced Chemical Engineering Projects
CHE 801 Seminar
CHE 810 Special Topics
CHE 885 Doctoral Supervised Teaching
CHE 890 Doctoral Preliminary Examination
CHE 893 Doctoral Supervised Research
CHE 895 Doctoral Dissertation Research
CHE 896 Summer Dissertation Research
CHE 899 Doctoral Dissertation Preparation

Chemistry

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Chemistry	Y		Y		Y		

GRADUATE FACULTY

M. G. Khaledi, ***Department Chair***

Director of Graduate Programs:
E. F. Bowden, Box 8204, 515.7069, edmond_bowden@ncsu.edu, Chemistry

Glaxo Distinguished University Professor: J. S. Lindsey
Howard J. Schaeffer Distinguished University Professor: B. M. Novak

Professors: A. J. Banks, E. F. Bowden, C. L. Bumgardner, D. L. Comins, S. Franzen, C. B. Gorman, K. W. Hanck, M. G. Khaledi, J. D. Martin, D. C. Muddiman, D. A. Shultz, G. H. Wahl Jr., M. H. Whangbo, J. L. Whitten; ***Professors Emeriti:*** R. D. Bereman, H. H. Carmichael, L. D. Freedman, F. W. Getzen, F. C. Hentz Jr., R. H. Loeppert, C. G. Moreland, S. T. Purrington, A. F. Schreiner, E. O. Stejskal, W. P. Tucker, R. C. White; ***Associate Professors:*** C. B. Boss, A. I. Smirnov, W. L. Switzer, D. W. Wertz, J. L. White; ***Associate Professors Emeriti:*** T. C. Caves; ***Assistant Professors:*** A. Deiters, R. A. Ghiladi, T. B. Gunnoe, L. He, E. A. Ison, P. Maggard, C. C. Melander, M. T. Oliver-Hoyo, T. I. Smirnova

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: D. W. Brenner

The Department of Chemistry offers programs of study leading to the Doctor of Philosophy, Master of Science and Master of Chemistry degrees. The Ph.D. and M.S. degrees are based on original research, while the Master of Chemistry degree is a non-research degree. Many research projects merge disciplines such as biochemistry, computational science, materials science, physics, statistics and toxicology with chemistry. General courses as well as advanced and special topics courses are offered.

Admission Requirements: Applicants should have an undergraduate degree in chemistry or in a closely related field with a strong chemistry background. A GPA of at least 3.0 in the sciences is needed for consideration. GRE General Test scores are strongly recommended, and the Subject Test is recommended. Admission decisions are made as completed applications are received. For most favorable consideration for the fall term, all application materials should be received by January 15 (domestic students) and January 1 (international students); for spring admission, by August 15.

Master's Degree Requirements: The Master of Science (M.S.) degree in chemistry is a research degree that requires six graduate courses and research leading to a thesis. The Master of Chemistry (M.C.) degree is a non-thesis degree requiring primarily coursework. Contact the Director of Graduate Programs for further details. The Master of Science (M.S.) degree in chemistry is a research degree that requires six graduate courses and research leading to a thesis. Both Master's degrees require a minimum of 30 credit hours of graduate work.

Doctoral Degree Requirements: In the doctoral program, emphasis is placed on original research and a comprehensive knowledge of one's chosen field.

Student Financial Support: Incoming graduate students are supported by departmental teaching assistantships.

Outstanding applicants are eligible for supplemental fellowships during their first year of study. Research assistantships are normally available to second-, third-, and fourth-year students. The department also has fellowships for students interested in the area of electronic materials, biotechnology and pharmaceutical and synthetic organic chemistry.

Other Relevant Information: The Department of Chemistry is one of five academic departments in the College of Physical and Mathematical Sciences. Fifteen new faculty members have been added in the last ten years, thereby greatly enhancing opportunities for graduate research especially in cutting edge interdisciplinary programs.

GRADUATE COURSES

CH 601 Seminar
CH 610 Special Topics
CH 615 Advanced Special Topics
CH 677 Advanced Chemistry Projects
CH 685 Master's Supervised Teaching
CH 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CH 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CH 690 Master's Examination
CH 693 Master's Supervised Research
CH 695 Master's Thesis Research
CH 696 Summer Thesis Research
CH 699 Master's Thesis Preparation
CH 701 Advanced Inorganic Chemistry I
CH 703 Advanced Inorganic Chemistry II
CH 705 Organometallic and Inorganic Reaction Mechanisms
CH(MSE) 707 Chemical Concepts in Materials Science and Engineering
CH 711 Advanced Analytical Chemistry I
CH 713 Advanced Analytical Chemistry II
CH 714 Electronics and Instrumentation Laboratory
CH 715 Chemical Instrumentation
CH 717 Physical Methods of Elemental Trace Analysis
CH 718 Trace Analysis Laboratory
CH 721 Advanced Organic Chemistry I
CH 723 Advanced Organic Chemistry II
CH 725 Physical Methods in Organic Chemistry
CH 727 Mass Spectrometry
CH 730 Advanced Physical Chemistry
CH 731 Chemical Thermodynamics I
CH 733 Chemical Kinetics
CH 736 Chemical Spectroscopy
CH 737 Quantum Chemistry
CH 739 Colloid Chemistry
CH 741 Analytical Spectroscopy
CH 743 Electrochemistry
CH 745 Chemical Separation
CH 755 Organic Reaction Mechanisms
CH 757 Chemistry of Metal-organic Compounds
CH 759 Natural Products
CH(MSE,TC) 762 Physical Chemistry of High Polymers--Bulk Properties
CH(MSE,TC) 772 Physical Chemistry of High Polymers--Solution Properties
CH 801 Seminar
CH 810 Special Topics
CH 815 Advanced Special Topics
CH 877 Advanced Chemistry Projects
CH 885 Doctoral Supervised Teaching
CH 890 Doctoral Preliminary Examination
CH 893 Doctoral Supervised Research
CH 895 Doctoral Dissertation Research
CH 896 Summer Dissertation Research
CH 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Civil Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Civil Engineering	Y		Y		Y		

GRADUATE FACULTY

G. F. List, ***Department Head***

Director of Graduate Programs:
V. C. Matzen, Box 7908, 515.7736, matzen@ncsu.edu, Civil Engineering

Distinguished Professor: S. H. Rizkalla

Professors: M. A. Barlaz, J. W. Baugh Jr., R. C. Borden, R. H. Borden, E. D. Brill Jr., H. C. Frey, M. A. Gabr, J. E. Hummer, D. W. Johnston, N. P. P. Khosla, Y. R. Kim, G. F. List, V. C. Matzen, J. M. Nau, M. F. Overton, M. S. Rahman, S. R. Ranjithan, W. J. Rasdorf, N. M. Rouphail; ***Professors Emeriti:*** M. Amein, P. D. Cribbins, R. A. Douglas, J. F. Ely, J. S. Fisher, A. K. Gupta, J. M. Hanson, K. S. Havner, C. L. Heimbach, Y. Horie, S. W. Nunnally, C. C. Tung, H. E. Wahls, P. Z. Zia; ***Associate Professors:*** A. C. Chao, F. L. de los Reyes III, J. J. Ducoste, A. Gupta, T. Hassan, D. R. Knappe, M. J. Kowalsky, M. L. Leming, G. Mahinthakumar, R. Seracino, J. R. Stone, A. A. Tayebali; ***Adjunct Associate Professors:*** L. R. Goode, D. R. van der Vaart; ***Associate Professors Emeriti:*** W. L. Bingham, E. D. Gurley, J. C. Smith; ***Assistant Professors:*** S. Arumugam, T. M. Evans, M. N. Guddati, M. Liu, E. Sumner, B. M. Williams, J. Yu; ***Research Assistant Professors:*** E. Zechman; ***Adjunct Assistant Professors:*** J. D. Bowen, D. H. Loughlin

Graduate programs are offered in coastal and water resources engineering, computer-aided engineering, construction engineering and management, environmental engineering, geotechnical engineering, public works engineering, structures and mechanics, transportation engineering and materials.

Admission Requirements: Normal minimum requirements include a 3.0 GPA in a related engineering major. Provisional admission may be granted to applicants who do not satisfy normal admission criteria but have other special qualifications. Applicants without academic experience in civil engineering, construction engineering, or environmental engineering may be required to take undergraduate courses to remove deficiencies, without graduate credit. The Graduate Record Examination normally is required of all applicants.

Master's Degree Requirements: Two Master's degrees, each requiring a minimum of 30 credit hours, are available. At least two-thirds of a Master's program should be in a well-defined major area of concentration. The M.CE. is a non-thesis (Option B) degree with other requirements, such as independent projects or core courses, specified in some areas of specialization. A formal minor is not permitted. The M.CE. is available both on-campus and through distance education. The M.S. degree requires a thesis and a formal minor is optional.

Doctoral Degree Requirements: The Ph.D. typically requires one year of full-time course work beyond the master's degree and research culminating in a dissertation. The program must develop a well-defined major area of concentration and may include supporting courses outside the major or a formal minor in a related field.

Student Financial Support: Departmental teaching and research assistantships are available including coverage of tuition and health insurance. Fellowships supplementing the assistantships, which may include coverage of academic fees, are available for exceptional U. S. applicants. All financial aid recipients are selected on merit-based competition with other applicants. Applications requesting financial aid should be submitted early: February 1 for Fall admission and by July 15 (international) or October 1 (U.S.) for Spring

admission, although these are not deadlines.

GRADUATE COURSES

CE 501 Transportation Systems Engineering
CE 502 Traffic Operations
CE 503 Highway Design
CE 504 Airport Planning and Design
CE 505 Advanced Airport Systems Design
CE 506 Transportation Engineering Data Collection and Analysis
CE 509 Highway Safety
CE 522 Theory and Design of Prestressed Concrete
CE 523 Theory and Behavior of Steel Structures
CE 524 Analysis and Design of Masonry Structures
CE 525 Structural Analysis II
CE(WPS) 528 Structural Design in Wood
CE 537 Computer Methods and Applications
CE 538 Information Technology and Modeling
CE 548 Engineering Properties of Soils I
CE 549 Soil and Site Improvement
CE 561 Construction Project Management
CE 564 Legal Aspects of Contracting
CE 567 Risk and Financial Management in Construction
CE 571 Physical Principles of Environmental Engineering
CE 572 Design of Water and Wastewater Facilities
CE 573 Biological Principles of Environmental Engineering
CE 574 Chemical Principles of Environmental Engineering
CE 576 Engineering Principles of Air Pollution Control
CE 577 Engineering Principles of Solid Waste Management
CE(MEA) 579 Principles of Air Quality Engineering
CE 580 Flow in Open Channels
CE 583 Engineering Aspects of Coastal Processes
CE 584 Hydraulics of Ground Water
CE 586 Engineering Hydrology
CE 588 Water Resources Engineering
CE 590 Special Topics in Civil Engineering
CE 591 Special Topics in Civil Engineering Computing
CE 592 Special Topics in Construction Engineering
CE 593 Special Topics in Geotechnical Engineering
CE 594 Special Topics in Structural Mechanics
CE 595 Special Topics in Transportation Engineering
CE 596 Special Topics in Water Resources and Environmental Engineering
CE 601 Civil Engineering Seminar
CE 602 Seminar in Civil Engineering Computing
CE 603 Seminar in Construction Engineering
CE 604 Seminar in Geotechnical Engineering
CE 605 Seminar in Structural Mechanics
CE 606 Seminar in Transportation Engineering
CE 607 Seminar in Water Resources and Environmental Engineering
CE 635 Advanced Reading in Civil Engineering
CE 675 Civil Engineering Projects
CE 685 Master's Supervised Teaching
CE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CE 693 Master's Supervised Research
CE 695 Master's Thesis Research
CE 696 Summer Thesis Research
CE 699 Master's Thesis Preparation
CE 701 Urban Transportation Planning
CE 702 Traffic Flow Theory
CE 705 Intelligent Transportation Systems
CE 706 Advanced Traffic Control
CE 707 Transportation Policy and Funding
CE 713 Theory of Elasticity I

CE 714 Stress Waves
CE 715 Advanced Strength of Materials
CE 717 Theory of Plates and Shells
CE 718 Plasticity and Limit Analysis
CE 720 Matrix and Finite Element Structural Analysis I
CE 721 Matrix and Finite Element Structural Analysis
CE 722 Structural Dynamics
CE 723 Advanced Structural Dynamics
CE 724 Probabilistic Methods of Structural Engineering
CE 725 Earthquake Structural Engineering
CE 726 Advanced Theory of Concrete Structures
CE 737 Computer-aided Engineering Systems
CE 741 Geomechanics of Stress and Deformation
CE 742 Deformation and Instability of Soils
CE 744 Foundation Engineering
CE 746 Soil Dynamics and Earthquake Engineering
CE 747 Geosynthetics in Geotechnical Engineering
CE 751 Theory of Concrete Mixtures
CE 753 Asphalt and Bituminous Materials
CE 755 Highway Pavement Design
CE 757 Pavement Management Systems
CE 759 Inelastic Behavior of Construction Materials
CE 761 Design of Temporary Structures in Construction
CE 762 Construction Productivity
CE 763 Materials Management in Construction
CE 765 Construction Equipment Systems
CE 766 Building Construction Systems
CE 771 Physical-Chemical Water Treatment Processes
CE(NE) 772 Environmental Exposure and Risk Analysis
CE 773 Hazardous Waste Management and Treatment
CE 774 Environmental Bioprocess Technology
CE 775 Modeling and Analysis of Environmental Systems
CE 776 Advanced Water Management Systems
CE(MEA) 779 Advanced Air Quality
CE 784 Ground Water Contaminant Transport
CE 785 Urban Stormwater Management
CE 790 Advanced Topics in Civil Engineering
CE 791 Advanced Topics in Civil Engineering Computing
CE 792 Advanced Topics in Construction Engineering
CE 793 Advanced Topics in Geotechnical Engineering
CE 794 Advanced Topics in Structural Mechanics
CE 795 Advanced Topics in Transportation Engineering
CE 796 Advanced Topics in Water Resources and Environmental Engineering
CE 801 Civil Engineering Seminar
CE 802 Seminar in Civil Engineering Computing
CE 803 Seminar in Construction Engineering
CE 804 Seminar in Geotechnical Engineering
CE 805 Seminar in Structural Mechanics
CE 806 Seminar in Transportation Engineering
CE 807 Seminar in Water Resources and Environmental Engineering
CE 839 Advanced Reading in Civil Engineering
CE 885 Doctoral Supervised Teaching
CE 890 Doctoral Preliminary Examination
CE 893 Doctoral Supervised Research
CE 895 Doctoral Dissertation Research
CE 896 Summer Dissertation Research
CE 899 Doctoral Dissertation Preparation

Communication

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Communication			Y				

GRADUATE FACULTY

K. Zagacki, ***Interim Department Head***

Director of Graduate Programs:
M. A. Johnson, Box 8104, 515.9756, melissa_johnson@ncsu.edu, Communication

Professors: V. J. Gallagher, W. J. Jordan, J. Keyton, R. L. Schrag, C. A. Smith, K. Zagacki; ***Associate Professors:*** K. Albada-Jelgersma, D. P. Dannels, D. A. DeJoy, E. T. Funkhouser, J. K. Jameson, M. A. Johnson, W. J. Kinsella, J. Kiwanuka-Tondo, R. Leonard, S. Miller-Cochran, J. Packer, S. R. Stein, S. B. Wiley; ***Associate Professors Emeriti:*** B. L. Russell; ***Assistant Professors:*** A. de Souza e Silva, A. C. Farr, J. Ingram, J. L. Moore, R. D. Waters

The Master of Science program in communication is designed to provide graduate-level expertise for solving problems in modern organizations and social systems from a communication perspective and addresses issues concerned with interpersonal, relational and technologically mediated communication systems essential to modern, networked organizations and societies. Its graduates will acquire advanced-level expertise in communication theory, research and applications that will improve processes and enhance outcomes within and across diverse social systems and will prepare them for higher-level managerial positions in their professions.

Admission Requirements: Applicants should have a minimum 3.0 GPA in the undergraduate major and a minimum of 3.0 over the last 60 hours of undergraduate work.

Master's Degree Requirements: The degree requires 36 credit hours with a minimum of 27 credit hours taken in communication; up to 9 hours may be taken outside of the department with the approval of the graduate advisor. Students will be required to complete 12 hours in communication theory, 6 hours in communication research methods and 9 hours in applied communication courses. They will also be required to complete 9 hours as electives to be chosen from among the first three groups of courses or up to 9 hours of electives may be taken outside the department with the approval of the graduate advisor.

GRADUATE COURSES

COM(ENG) 514 History of Rhetoric
COM(ENG) 516 Rhetorical Criticism: Theory and Practice
COM 520 Seminar in Crisis Communication
COM 521 Communication and Globalization
COM 522 Critical Approaches to Organizational Communication
COM 523 International and Intercultural Communication
COM 524 Political Communication in Organizations
COM 525 Communication and Decision Making
COM 526 Media Ownership
COM 527 Seminar in Organizational Conflict Management
COM 528 Communication Culture and Technology
COM 541 Quantitative Research Methods in Applied Communication
COM 542 Qualitative Research Methods in Applied Communication
COM 556 Seminar in Organizational Communication
COM 561 Human Communication Theory
COM 562 Communication and Social Change

COM 585 Teaching College Communication
COM 598 Special Topics in Communication
COM 630 Independent Study
COM 685 Master's Supervised Teaching
COM 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
COM 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
COM 690 Master's Examination
COM 693 Master's Supervised Research
COM 798 Special Topics in Communication
COM 810 Directed Readings in Communication

NCSU Graduate Catalog

College of Humanities & Social Sciences

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Communication Rhetoric and Digital Media	Y						

GRADUATE FACULTY

Director of Graduate Programs:
C. R. Miller, Box 8101, 515.4126, crmiller@ncsu.edu, Communication, Rhetoric and Digital Media

SAS Distinguished Prof in Technical Communication & DPG, Communication, Rhetoric & Digital Media:
C. R. Miller

Professors: C. M. Anson, M. P. Carter, B. D. Faber, V. J. Gallagher, W. J. Jordan, H. Kellner, A. M. Penrose, R. L. Schrag, K. Zagacki; ***Associate Professors:*** K. Albada-Jelgersma, D. H. Covington, D. P. Dannels, R. S. Dicks, J. K. Jameson, M. A. Johnson, S. M. Katz, W. J. Kinsella, J. Kiwanuka-Tondo, S. R. Stein, J. Swarts, S. B. Wiley; ***Assistant Professors:*** A. C. Farr, J. Ingram, D. M. Rieder

The interdisciplinary Ph.D. program in Communication, Rhetoric, and Digital Media (CRDM) is offered by the College of Humanities and Social Sciences with the cooperation of the Department of Communication and the Department of English. Built on the premise that new developments in communication media and information technologies require a dramatic shift in instruction and research, the program integrates the study of oral, written, and visual modes of communication to focus on the human dimensions of information and communication technologies.

Students can create programs of study in areas such as computer-mediated communication, visual rhetoric, digital culture, electronic communication across the curriculum, media and technology policy, textual mediation, digital literacy, and online information design. Graduates will help meet the increasing national demand for faculty with technology specializations to teach and lead programs in areas such as writing and speaking across the curriculum, organizational and interpersonal communication, composition studies, technical communication, rhetorical studies, and media studies. Industry and government also need professionals to conduct research, manage development, and analyze policy in the uses and applications of new communication technologies.

Admission Requirements: Master's degree in Communication, English, Rhetoric, or other relevant field with GPA of 3.0 or better. Master's level work should include one quantitative or qualitative methods course, as well as three courses in an approved disciplinary area and one in a second disciplinary area. Applicants who are otherwise well qualified may make up these courses after admission. GRE scores, a statement of goals and interests, a resume of work experience, and a writing sample are also required for application to the program. See our website for more detail.

The application deadline for Fall semester admission is February 1. The program will notify applicants of admission decisions by March 1 and expects acceptance of admission offers by April 15.

Ph.D. Degree Requirements: A minimum of 56 hours beyond the Master's degree are required to complete the Ph.D. program: 15 credit hours of core courses, 3 hours of research methods, 6 hours of professional preparation, 12 hours in an elective focus area, and 20 hours of research and dissertation. Students entering directly from a Master's program at NC State may be able to count additional Master's work toward some of these requirements.

Student Financial Support: The CRDM program offers a limited number of Teaching Assistantships, with a stipend, health insurance, and tuition (excluding fees). Teaching Assistants will be assigned according to their interests and qualifications to either the Communication or the English Department with the possibility of teaching in both departments during their course of study; those who do not have sufficient qualifications to teach in the first semester will participate in a training program. Some Research Assistantships may also be available.

GRADUATE COURSES

CRD 701 History and Theory of Communication Technology
CRD 702 Rhetoric and Digital Media
CRD 703 Communication in Networked Society
CRD 704 Technologies and Pedagogies in the Communication Arts
CRD 790 Issues in Communication, Rhetoric, and Digital Media
CRD 791 Special Topics in Communication, Rhetoric, and Digital Media
CRD 809 Colloquium in Communication, Rhetoric, and Digital Media
CRD 885 Doctoral Supervised Teaching
CRD 890 Doctoral Preliminary Examination
CRD 893 Doctoral Supervised Research
CRD 895 Doctoral Dissertation Research
CRD 896 Summer Dissertation Research
CRD 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Comparative Biomedical Sciences

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Comparative Biomedical Sciences	Y		Y				

GRADUATE FACULTY

Director of Graduate Programs:
S. L. Jones, Box 8401, 513.7722, sam_jones@ncsu.edu, Comparative Biomedical Sciences

Burroughs Wellcome Distinguished Professor: J. E. Riviere

Professors: K. B. Adler, G. W. Almond, K. L. Anderson, R. R. H. Anholt, H. J. Barnes, E. B. Breitschwerdt, T. T. Brown Jr., J. M. Cullen, G. A. Dean, L. N. Fleisher, F. J. Fuller, J. S. Guy, B. Hammerberg, E. C. Hawkins, L. Jaykus, J. F. Levine, M. G. Levy, D. H. Ley, N. A. Monteiro-Riviere, E. J. Noga, P. E. Orndorff, M. G. Papich, J. Piedrahita, M. C. Roberts, P. L. Sannes, B. Sherry, R. C. Smart, J. W. Spears, M. K. Stoskopf, D. E. Thrall; ***Research Professors:*** A. R. Brody, S. Kennedy-Stoskopf, M. C. McGahan; ***Adjunct Professors:*** M. W. Dewhirst, C. Lau; ***Associate Professors:*** P. Arasu, R. Baker, R. E. Baynes, A. T. Blikslager, M. Breen, M. T. Correa, P. Cowen, P. W. Farin, J. E. Gadsby, B. Gilger, J. M. Horowitz, S. L. Jones, J. M. Law, S. L. Marks, P. E. Mozdziak, N. Olby, M. Schramme, B. D. Slenning; ***Adjunct Associate Professors:*** D. C. Dorman, J. A. Dye, W. A. Gebreyes, R. W. Litaker, R. C. Sills; ***Assistant Professors:*** J. Barnes, A. Birkenheuer, S. Y. Gardner, I. Gimeno, J. Gookin, M. L. Hauck, Y. Kim, K. E. Linder, L. D. Martin, N. Nascone-Yoder, C. R. F. Pinto, D. Reddy, M. Rodriguez-Puebla, G. Smith, J. Yoder; ***Research Assistant Professors:*** T. Ghashghaei, X. Xia; ***Adjunct Assistant Professors:*** D. E. Malarkey

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: S. M. Laster, W. E. M. Morrow; ***Associate Professors:*** J. M. Hinshaw

Course offerings and research topics currently include, but are not limited to: cell biology, genomics, infectious diseases, developmental biology, immunology, cardiology, pharmacokinetics, oncology, toxicology, gastroenterology, neuroscience, reproductive physiology, biotechnology, microbiology, aquatic/ wildlife biology, biomedical engineering, endocrinology, molecular biology, pulmonary biology, epidemiology, population medicine, health systems monitoring, transplantation and radiology.

Admission Requirements: All applications are reviewed by the Graduate Studies Committee of the CBS Program, composed of faculty members representing each area of the graduate program and a graduate student representative. Scores from the GRE are required for admission by all applicants. Candidates who do not have a DVM degree must have a baccalaureate degree or advanced degree from a college or university recognized as standard by a regional or general accrediting agency. Students with a 3.0 (on a 4.0 scale) undergraduate or DVM curriculum with appropriate course background will be considered for admission.

Doctoral Degree Requirements: Credit hour requirements for the Ph.D. degree are determined by the graduate student's committee with approval of the Director of Graduate Programs and the Graduate School.

Student Financial Support: Research assistantships are awarded to qualified candidates on the competitive basis by the College. These are for 12-month periods, and stipends are competitive with those of other programs. These positions are funded by the grants of individual faculty members and the state appropriations to the College and departments.

Other Relevant Information: The program is organized as five areas of concentration which include: cell biology, epidemiology/ population medicine, infectious diseases, pathology, and pharmacology. These provide extensive interdisciplinary training and maintain a highly effective liaison with graduate programs in other colleges of the university, as well as those of nearby Duke University and the University of North Carolina at Chapel Hill.

GRADUATE COURSES

CBS 565 Fundamentals of Biomedical Sciences
CBS 580 Clinical Veterinary Epidemiology
CBS 595 Special Topics
CBS(ANS,PHY,ZO) 602 Seminar in Biology of Reproduction
CBS 610 Special Topics
CBS 685 Master's Supervised Teaching
CBS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CBS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CBS 690 Master's Examination
CBS 693 Master's Supervised Research
CBS 695 Master's Thesis Research
CBS 696 Summer Thesis Research
CBS 699 Master's Thesis Preparation
CBS 730 Veterinary Histology
CBS 731 Applied Veterinary Anatomy I
CBS 732 Biological Light and Electron Microscopy: Principles and Practice
CBS 740 Research Animal Care and Use
CBS 742 Advanced Systemic Histopathology
CBS 743 Toxicologic Pathology I
CBS 751 Pathogenic Bacteriology and Mycology
CBS 752 Diagnostic Bacteriology and Mycology
CBS 753 Veterinary Immunology
CBS 754 Principles of Analytical Epidemiology
CBS(IMM) 755 Immunoparasitology
CBS(IMM,PHY,PO) 756 Immunogenetics
CBS(VPH) 760 Molecular Epidemiology of Infectious Diseases of Veterinary and Public Health Importance
CBS 762 Principles of Pharmacology
CBS(ANS,NTR,PHY) 764 Advances in Gastrointestinal Pathophysiology
CBS 770 Cell Biology
CBS(TOX) 771 Cancer Biology
CBS 773 Advanced Developmental Biology
CBS 774 Epidemiology of Infectious Diseases of International Importance
CBS 780 Veterinary Production Epidemiology
CBS 782 Marine Mammal Medicine
CBS(IMM,MB) 783 Advanced Immunology
CBS 785 Advanced and Molecular Pharmacology
CBS 787 Pharmacokinetics
CBS 790 Special Topics in Clinical Pathology
CBS 795 Special Topics
CBS 800 Seminar
CBS(ANS,PHY,ZO) 802 Seminar in Biology of Reproduction
CBS 803 Seminar in Surgical Pathology
CBS 804 Seminar in Necropsy Pathology
CBS 805 Seminar in Pharmacology
CBS 806 Seminar in Cell Biology
CBS(IMM) 807 Seminar in Veterinary Microbiology/ Immunology
CBS 810 Special Topics
CBS 812 Special Topics in Pathology
CBS 813 Special Topics in Laboratory Pharmacology
CBS 815 Advanced Topics in Virology
CBS 817 Advanced Topics in Zoological Medicine I
CBS 818 Advanced Topics in Zoological Medicine II
CBS 860 Techniques in Pharmacological Research
CBS 861 Bacterial Pathogenic Mechanisms
CBS 862 Professional Conduct in Biomedical Research

CBS 885 Doctoral Supervised Teaching
CBS 890 Doctoral Preliminary Examination
CBS 893 Doctoral Supervised Research
CBS 895 Doctoral Dissertation Research
CBS 896 Summer Dissertation Research
CBS 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Computer Networking

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Computer Networking			Y				

GRADUATE FACULTY

Directors of Graduate Programs:
D. J. Thuente, Box 8206, 515.7003, thuente@csc.ncsu.edu, Computer Science
L. Lunardi, Box 7911, 513.7362, leda_lunardi@ncsu.edu, Electrical & Computer Engineering

Alan T. Dickson Distinguished University Professor: M. A. Rappa
Alcoa Professor of Electrical and Computer Engineering: A. Huang
Alton and Mildred Lancaster Distinguished Professor and Department Head: R. J. Trew
Distinguished Professor of Electrical and Computer Engineering: J. R. Hauser, N. A. Masnari
Distinguished University Professor: B. J. Baliga
Lampe Professor of Electrical and Computer Engineering: M. B. Steer

Professors: W. E. Alexander, S. M. Bedair, G. L. Bilbro, M. Chow, T. M. Conte, M. Devetsikiotis, A. Duel-Hallen, P. D. Franzon, J. J. Grainger, E. Grant, B. L. Hughes, G. J. Iafrate, S. P. Iyer, K. W. Kim, R. M. Kolbas, H. Krim, L. Lunardi, D. F. McAllister, T. K. Miller III, H. T. Nagle Jr., A. A. Nilsson, C. M. Osburn, M. C. Ozturk, H. G. Perros, S. A. Rajala, D. S. Reeves, G. N. Rouskas, M. P. Singh, W. E. Snyder, J. K. Townsend, H. J. Trussell, I. Viniotis, M. A. V. Vouk; ***Adjunct Professors:*** P. R. Wurman; ***Associate Professors:*** S. T. Alexander, A. I. Anton, M. E. Baran, G. T. Byrd, A. G. Dean, R. Dutta, G. Lazzi, V. Misra, J. F. Muth, P. Ning, I. Rhee, E. Rotenberg, M. W. White, L. A. Williams; ***Assistant Professors:*** D. Barlage, H. Dai, W. R. Davis, M. Escuti, D. Y. Eun, K. Gard, M. Ghovanloo, X. Liu, S. Sair, M. L. Sichitiu, Y. Solihin, J. M. Tuck III, W. Wang; ***Adjunct Assistant Professors:*** L. J. Bottomley, A. J. Rindos III

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: W. J. Stewart

The Master of Science in computer networking may be earned through the M.S. with thesis option or through the non-thesis option. Either option may be used as preparation for further graduate study or employment in industrial research, development or design environment, although students planning to continue on for a Ph.D. should discuss the option selected with their advisors.

Admission Requirements: Admissions criteria will adhere to those currently listed on the program website: http://networking.ncsu.edu

Master's Degree Requirements: Computer networking core courses constitute 9 of the 30 minimum credit hours. Students take 12 additional credit hours of computer networking courses from one of three currently defined technical concentration areas: network design, network hardware, or network software. The remaining 9 credit hours may be taken from an approved management concentration sequence, as additional courses in the computer networking technical concentration areas, or as 6 hours of thesis and 3 credit hours from the list of approved computer networking courses. At least 6 of the 30 credits must come from the 700 level, and non-letter graded courses such as individual studies courses may account for a maximum of 3 credit hours.

CORE COURSES

CSC(ECE) 570 Computer Networks
CSC(ECE) 579 Introduction to Computer Performance Modeling
BUS 510 Managing the Digital Enterprise (or any courses below marked *)

TECHNICAL CONCENTRATIONS
CSC 501 Operating System Principles
CSC/ECE 506 Architecture of Parallel Computers
CSC/ECE 510 Software Engineering
CSC 557 Multimedia Technology
CSC/ECE 573 Internet Protocols
CSC 574 Information Systems Security
CSC/ECE 575 Introduction to Wireless Networking
CSC/ECE 576 High Speed Networks
CSC 715 Concurrent Software System
CSC/ECE 773 Advanced Topics in Internet Protocols
CSC/ECE 774 Network Security
CSC/ECE 776 Performance Evaluation of Computer Networks
CSC/ECE 777 Telecommunications Network Design
CSC/ECE 779 Advanced Computer Performance Modeling
CSC/ECE 791 Advanced Topics: Optical Networks
ECE 520 Digital ASIC Design
ECE 521 Computer Design and Technology
ECE 714 Random Processes
ECE 746 VLSI System Design
ECE/CSC 791 Special Topics: Wireless Networks
ECE 792 Special Topics: Advanced Network Protocol Design
ECE 792 Special Topics: Photonics and Optical Communications
ECE 791 Special Topics: Wireless Communication Systems.

MANAGEMENT CONCENTRATION
*BUS 504 Technology, Law and the Internet
*BUS 510 Managing the Digital Enterprise
*BUS 564 Project Management
BUS 565 Product Design & Development
BUS 573 Supply Chain Management
*BUS 576 Technology Evaluation and Commercialization Concepts
BUS 577 High Technology Entrepreneurship
BUS 578 Implementing Technology Commercialization Strategies
BUS 579 Entrepreneurship
BUS 590 Special Topics: Business Process Analysis
BUS 590 Special Topics: Innovation Management
*BUS 590 Special Topics: Management of Technology
CSC 513 E-Commerce Technology
CSC 516 E-Commerce Practicum
CSC 522 Automated Learning and Data Analysis

Computer Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Computer Science	Y		Y		Y		

GRADUATE FACULTY

M. A. V. Vouk, ***Department Head***

Director of Graduate Programs:
D. J. Thuente, Box 8206, 515.7003, thuente@csc.ncsu.edu, Computer Science

Distinguished University Research Professor: D. L. Bitzer
SAS Institute Distinguished Professor: J. Doyle

Professors: E. W. Davis Jr., R. J. Fornaro, E. F. Gehringer, S. P. Iyer, D. F. McAllister, H. G. Perros, D. S. Reeves, R. D. Rodman, G. N. Rouskas, C. D. Savage, M. P. Singh, W. J. Stewart, A. L. Tharp, D. J. Thuente, M. A. V. Vouk; ***Adjunct Professors:*** D. A. Reed, P. R. Wurman; ***Professors Emeriti:*** W. Chou, R. E. Funderlic; ***Associate Professors:*** A. I. Anton, D. R. Bahler, R. Dutta, V. W. Freeh, C. G. Healey, T. L. Honeycutt, J. C. Lester, F. Mueller, P. Ning, I. Rhee, N. Samatova, R. A. St. Amant, M. F. M. Stallmann, B. A. Watson, L. A. Williams, R. M. Young; ***Assistant Professors:*** R. Y. Chirkova, K. A. Harfoush, S. Heber, X. Ma, K. A. Ogan, T. Xie, T. Yu; ***Adjunct Assistant Professors:*** J. Kang, D. M. Pase, A. J. Rindos III, X. Wang

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: M. A. Rappa, J. W. Baugh, Jr., T. M. Conte, M. Devetsikiotis, E. L. Kaltofen, C. D. Meyer, Jr., T. K. Miller, III, W. E. Snyder, I. Viniotis; ***Associate Professors:*** G. T. Byrd, A. G. Dean, G. Lazzi, E. Rotenberg, J. S. Scroggs; ***Assistant Professors:*** M. L. Sichitiu, Y. Solihin, W. Wang

The Department of Computer Science has become one of the leading departments in the country and indeed the world. Recent developments include adding over 20 tenure-track faculty, 16 of whom received NSF CAREER development awards. Total research expenditures have quadrupled over the last few years and graduate enrollments have climbed to nearly 500 students. The faculty has broad-ranging research strengths including networking, intelligent and collaborative systems, secure and reliable systems, parallel and embedded systems, software and systems engineering, and algorithms and theory. Areas of strength in applied research include bioinformatics, scientific computation, e-commerce and data mining.

Admission Requirements: Minimum application requirements include an accredited Bachelor's degree with at least a B average and computer science course work at least equivalent to a strong minor. Applicants must submit scores for the GRE General Tests. It is recommended that financial aid and Ph.D. applicants also take the GRE Computer Science Subject Test.

Master's Degree Requirements: The M.S. requires 30 graduate credits including at least one course from each of the core areas of Theory (CSC 505, 512, 565, 579, 580, and 707) and Systems (CSC 501, 506, 510, 520, 540, 562, and 570) and thesis research (typically six credits). The advisory committee may waive the thesis requirement for students planning to pursue the Ph.D. who pass the Ph.D. written preliminary examination and complete specified additional course work in lieu of thesis research. The Master of Computer Science (M.C.S.) is a professional degree granted upon successful completion of 30 hours of course work, including a total of three courses from the two core areas and CSC 600. The M.C.S. degree is offered as an on-campus program or as a distance education program. The Master of Science in Computer Networking (M.S.C.N.) is a 30 credit-hour

degree offered as either a thesis or non-thesis program.

Doctoral Degree Requirements: Ph.D. students normally complete 72 semester hours of post-baccalaureate course work. They must also complete at least two courses from each of the two core areas with at least a 3.5 GPA and two 700-level CSC courses, individualized in-depth written and oral preliminary examinations, and a public defense of their dissertation describing substantial, original, and independent scholarly work.

Student Financial Support: During 2006-2007 academic year, approximately 180 students held teaching and research assistantships. The Department also has Nortel, IBM, GEM, Alumni, Provost's, and Dean’s Fellowships, which are awarded to outstanding candidates. In addition, the Department's Industrial Assistantship and Fellowship Programs and Co-ops provide graduate student RA positions and part-time work at IT firms across the country.

Other Relevant Information: Graduates at all levels are highly respected and recruited. They well paid locally and throughout the country and the world. Many Master's degree graduates begin or continue careers in advanced networking or software development in the Research Triangle Park and on the West Coast at companies such as IBM and Cisco. Many recent Ph.D.s have positions of technical leadership in well-known large companies and prominent research laboratories including Google, Microsoft Research, and IBM Research Labs or have obtained tenure-track faculty positions at Research I institutions.

GRADUATE COURSES

CSC 501 Operating Systems Principles
CSC 503 Computational Applied Logic
CSC 505 Design and Analysis of Algorithms
CSC(ECE) 506 Architecture of Parallel Computers
CSC 510 Software Engineering
CSC 512 Compiler Construction
CSC 513 Electronic Commerce Technology
CSC(BUS) 516 E-Commerce Practicum
CSC(ECE) 517 Object-oriented Languages and Systems
CSC 520 Artificial Intelligence I
CSC 522 Automated Learning and Data Analysis
CSC 523 Computational Linguistics
CSC 530 Computational Methods for Molecular Biology
CSC 540 Database Management Concepts and Systems
CSC 541 Advanced Data Structures
CSC(IE) 546 Management Decision and Control Systems
CSC 548 Parallel Systems
CSC 554 Human-Computer Interaction
CSC(IE) 556 Voice Input/Output Communication Systems
CSC 557 Multimedia Computing and Networking
CSC 562 Computer Graphics
CSC(MA,OR) 565 Graph Theory
CSC(ECE) 570 Computer Networks
CSC(ECE) 573 Internetwork Protocols and Architectures
CSC 574 Information Systems Security
CSC(ECE) 575 Introduction to Wireless Networking
CSC(ECE) 576 Connection-Oriented Networks
CSC(ECE,OR) 579 Introduction to Computer Performance Modeling
CSC(MA) 580 Numerical Analysis I
CSC 582 Computer Models of Interactive Narrative
CSC(MA) 583 Introduction to Parallel Computing
CSC 591 Special Topics in Computer Science
CSC 600 Computer Science Graduate Orientation
CSC 630 Individual Study in Computer Science
CSC 685 Master's Supervised Teaching
CSC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CSC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CSC 690 Master's Examination

CSC 693 Master's Supervised Research
CSC 695 Master's Thesis Research
CSC 696 Summer Thesis Research
CSC 699 Master's Thesis Preparation
CSC 707 Automata, Languages and Computability Theory
CSC 712 Software Testing and Reliability
CSC 714 Real Time Computer Systems
CSC 715 Concurrent Software Systems
CSC 716 Design of Secure and Reliable Systems
CSC 720 Artificial Intelligence II
CSC 723 Computational Semantics
CSC 725 Intelligent Multimedia Systems
CSC 742 Database Management Systems
CSC 743 Secure Data Management
CSC(ECE) 748 Parallel Processing
CSC 750 Service-Oriented Computing
CSC(IE) 756 Advances in Voice Input/output Communications Systems
CSC 761 Advanced Topics in Computer Graphics
CSC(OR,IE) 762 Computer Simulation Techniques
CSC 766 Code Optimization for Scalar and Parallel Programs
CSC(ECE) 773 Advanced Topics in Internet Protocols
CSC(ECE) 774 Advanced Network Security
CSC(ECE) 775 Advanced Topics in Wireless Networking
CSC(ECE) 776 Design and Performance Evaluation of Network Systems and Services
CSC(ECE) 777 Telecommunications Network Design
CSC(ECE) 778 Optical Networks
CSC(ECE) 779 Advanced Computer Performance Modeling
CSC(MA) 780 Numerical Analysis II
CSC(MA) 783 Parallel Algorithms and Scientific Computation
CSC 791 Advanced Topics in Computer Science
CSC 801 Seminar in Computer Science
CSC 830 Advanced Individual Study in Computer Science
CSC 885 Doctoral Supervised Teaching
CSC 890 Doctoral Preliminary Examination
CSC 893 Doctoral Supervised Research
CSC 895 Doctoral Dissertation Research
CSC 896 Summer Dissertation Research
CSC 899 Doctoral Dissertation Preparation

Crop Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Crop Science	Y		Y		Y		

GRADUATE FACULTY

W. D. Smith, ***Interim Department Head***

Director of Graduate Programs:
R. Wells, Box 7620, 515.4062, randy_wells@ncsu.edu, Crop Science

Distinguished University Professor: M. M. Goodman
Philip Morris Professor of Crop Science: W. D. Smith
William Neal Reynolds Professor of Crop Science: A. C. York

Professors: A. H. Bruneau, R. J. Cooper, R. E. Dewey, E. J. Dunphy, K. L. Edmisten, C. H. Haigler, R. W. Heiniger, T. G. Isleib, D. L. Jordan, R. C. Long, G. Miller, J. P. Mueller, J. P. Murphy, R. P. Patterson, C. H. Peacock, R. Qu, R. C. Rufty, T. W. Rufty Jr., J. F. Spears, H. T. Stalker Jr., A. K. Weissinger, P. R. Weisz, R. Wells, G. G. Wilkerson, J. C. Wynne, F. H. Yelverton; ***Professors (USDA):*** J. C. Burns, J. W. Burton, T. E. Carter Jr., E. L. Fiscus, J. B. Holland, D. S. Marshall, R. F. Wilson; ***Professors Emeriti:*** C. A. Brim, B. E. Caldwell, D. S. Chamblee, H. D. Coble, W. K. Collins, W. A. Cope, F. T. Corbin, D. A. Emery, W. T. Fike Jr., J. T. Green Jr., H. D. Gross, G. R. Gwynn, G. L. Jones, J. A. Lee, W. M. Lewis, H. M. Linker, D. E. Moreland, G. F. Peedin, H. Seltmann, G. A. Sullivan, D. L. Thompson, D. H. Timothy, J. B. Weber, W. W. Weeks, A. D. Worsham; ***Associate Professors:*** D. C. Bowman, D. A. Danehower, J. Luginbuhl; ***Associate Professors (USDA):*** G. Brown-Guedira, K. O. Burkey, P. Kwanyuen, D. P. Livingston III; ***Associate Professors (USDI/USFS):*** F. L. Booker; ***Associate Professors Emeriti:*** R. D. Keys; ***Assistant Professors:*** M. G. Burton, A. J. Cardinal, L. R. Fisher, R. Lewis, C. Reberg-Horton, R. Richardson, M. Schroeder; ***Research Assistant Professors:*** S. Weissinger

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: W. F. Thompson

The Department of Crop Science offers programs of study leading to the Master of Crop Science (M.C.S.), Master of Science (M.S.) and Doctorate of Philosophy (Ph.D.) degrees. The M.S. and Ph.D. programs are based upon original research while the M.C.S degree is a non-thesis degree program. Areas of study in the department include plant breeding, genetics and molecular biology; crop production, management, chemistry and physiology; sustainable agriculture and agro-ecology; turf grass management and science; integrated pest management, weed science and crop modeling.

Excellent facilities for graduate education are available, including wet and dry labs for preparation and analysis of plant and soil samples, cold storage facilities, greenhouses, controlled environmental chambers, computing facilities and the Southeastern Plant Environment Laboratories (Phytotron) for highly controlled plant environmental research. Agriculturally, North Carolina has a wide array of environments and soils for field research. This includes the sandy coastal plains and black lands of eastern NC, the central Piedmont with its clay soils, and the mountains of NC with their unique environments and soils. University and State research stations are located strategically throughout each of these regions and are widely used for field research.

Crop Science programs also benefit from strong cooperative ties with other departments and institutions.

Graduate students in Crop Science work cooperatively with and/or obtain instruction in the Departments of Animal Science, Biochemistry, Chemistry, Computer Science, Entomology, Horticultural Science, Genetics, Mathematics, Microbiology, Plant Biology, Plant Pathology, Soil Science and Statistics. Cooperative efforts link our programs with faculty at a number of land grant and international universities as well as with leaders in agribusiness and environmental protection.

Admissions Requirements: Prospective students should be graduates of an accredited university with a major in agronomy, animal science, biology, crop science, genetics, horticulture, plant science or related field of study. Graduates from other degree programs will be considered but may be asked to make up certain undergraduate deficiencies. Acceptance of applicants is competitive and limited by program space and funding. Applicants should have a minimum of a 3.0 (out of 4.0) GPA and a minimum combined GRE score of 1000 on the verbal and quantitative portions of the exam. Exceptions to these guidelines may be made for students with special backgrounds, abilities or interests

Master's Degree Requirements: *Master of Science Degree:* Requirements include a minimum of 30 semester hours of course work, including one hour of Seminar (CS 601) and six hours of Statistics (ST 511 and ST 512 or equivalent), completion of a thesis, a comprehensive oral examination and presentation of an exit seminar. *Master of Crop Science Degree:* M.C.S. requirements include a minimum of 36 semester hours of graduate work with a minimum of four, but no more than six, credit hours of Special Problems (CS 620). One hour of Crop Science Seminar (CS 601), three hours of Statistics (ST 511 or equivalent) and presentation of an exit seminar are also required.

Doctoral Degree Requirements: Ph.D. Candidates must demonstrate an ability to conduct original research and scholarly work at the highest level and produce an acceptable dissertation. Doctoral students must take a minimum of 72 graduate credit hours beyond the Bachelor's degree. They must also pass a preliminary examination (written and oral components) and a final oral examination. Presentation of an exit seminar is required.

Student Financial Support: Graduate assistantships and fellowships will be awarded to qualified applicants depending on funding availability and program space. Tuition is typically waived for students granted assistantships. Student health insurance is also provided to all students on assistantship.

Other Relevant Information: A thesis (M.S. and Ph.D.) or special problem (Master of Crop Science) outline and Plan of Graduate Work should be submitted to the Director of Graduate Programs by the end of the first regular (spring or fall) semester.

GRADUATE COURSES

CS(HS,PP) 502 Plant Disease: Methods and Diagnosis
CS(HS) 541 Plant Breeding Methods
CS 565 Turf Management Systems and Environmental Quality
CS 590 Special Topics
CS 601 Seminar
CS 620 Special Problems
CS 685 Master's Supervised Teaching
CS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
CS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
CS 690 Master's Examination
CS 693 Master's Supervised Research
CS 695 Master's Thesis Research
CS 696 Summer Thesis Research
CS 699 Master's Thesis Preparation
CS 711 Tobacco Technology
CS 713 Physiological Aspects of Crop Production
CS 714 Crop Physiology: Plant Response to Environment
CS(HS) 715 Weed Science Research Techniques
CS(HS) 716 Weed Biology

CS(HS) 717 Weed Management Systems
CS(HS) 718 Biological Control of Weeds
CS(GN) 719 Origin and Evolution of Cultivated Plants
CS(GN,HS) 720 Molecular Biology in Plant Breeding
CS(HS,SSC,TOX) 725 Pesticide Chemistry
CS(HS,SSC,TOX) 727 Pesticide Behavior and Fate in the Environment
CS(HS) 729 Herbicide Behavior in Plants
CS(GN,HS) 745 Quantitative Genetics in Plant Breeding
CS(GN,HS) 746 Breeding Methods
CS(GN,HS,PP) 748 Breeding for Pest Resistance
CS 795 Special Topics in Crop Science
CS 801 Seminar
CS 820 Special Problems
CS(GN,HS) 860 Plant Breeding Laboratory
CS(GN,HS) 861 Plant Breeding Laboratory
CS 885 Doctoral Supervised Teaching
CS 890 Doctoral Preliminary Examination
CS 893 Doctoral Supervised Research
CS 895 Doctoral Dissertation Research
CS 896 Summer Dissertation Research
CS 899 Doctoral Dissertation Preparation

Curriculum and Instruction

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Counselor Education	Y		Y			Y	
Counselor Education, Agency Counseling			Y			Y	
Counselor Education, Student Personnel in Higher Education			Y			Y	
Curriculum and Instruction	Y		Y			Y	
Curriculum and Instruction, Elementary Education			Y			Y	
Curriculum and Instruction, English Education			Y			Y	
Curriculum and Instruction, Reading			Y			Y	
Curriculum and Instruction, Social Studies Education			Y			Y	
Instructional Technology - Computers			Y			Y	
Middle Grades Education			Y			Y	
Special Education			Y			Y	
Special Education, Behavior Disorders			Y			Y	
Special Education, Learning Disabilities			Y			Y	
Special Education, Mental Retardation			Y			Y	

GRADUATE FACULTY

E. S. Vasu, ***Department Head***, Curriculum and Instruction
S. R. Ting, ***Asst. Dept. Head***, Curriculum and Instruction

Directors of Graduate Programs:
R. J. Pritchard, Box 7801, 515.1784, ruie_pritchard@ncsu.edu, Curriculum and Instruction
S. R. Ting, Box 7801, 515.6362, raymond_ting@ncsu.edu, Curriculum and Instruction

Professors: S. B. Baker, C. L. Crossland, D. A. Cullinan, B. J. Fox, E. R. Gerler Jr., P. L. Marshall, E. McIntyre, T. P. O'Brien, J. A. Picart, G. Ponder, C. A. Pope, B. R. Poulton, R. J. Pritchard, E. J. Sabornie, H. A. Spires, E. S. Vasu; ***Professors Emeriti:*** L. K. Jones, D. D. Locke, N. A. Sprinthall; ***Associate Professors:*** C. M. Beal, J. K. Lee, S. Nassar-McMillan, J. Osborne, S. S. Osborne, A. J. Reiman, R. D. Safrit, S. S. Snyder, S. R. Ting; ***Visiting Associate Professors:*** T. Oppewal, T. H. Stafford Jr.; ***Adjunct Associate Professors:*** B. Gorham; ***Associate Professors Emeriti:*** J. F. Arnold, B. C. Talley, L. Thies-Sprinthall; ***Assistant Professors:*** S. Carrier, D. B. Cherukuri, J. DeCuir-Gunby, H. C. Edwards, M. A. Grimmett, L. B. Holcomb, M. Jeffries, J. Minogue, J. Nietfeld, K. M. Oliver, J. R. Smith, M. Stumpf-Downing, A. Wiseman, C. A. Young; ***Research Assistant Professors:*** A. Overbay; ***Visiting Assistant Professors:*** J. S. Hall, H. Lupton-Smith, M. Terhaar-Yonkers; ***Adjunct Assistant Professors:*** R. E. Callanan, T. E. H. Conway, D. Crissman, L. Grable, R. Honeycutt, L. Huffman, S. T. Johnson, M. Monaco, R. C. Sutton

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: C. K. Coe, D. M. Daley; ***Associate Professors:*** E. O'Sullivan, J. E. Swiss

Curriculum and Instruction: The Department offers Master's degrees in curriculum and instruction, curriculum and instruction with a concentration in business and marketing education, English education, instructional technology, middle grades education, reading education, social studies education, and special

education with areas of concentration in curriculum /supervision. Master's degrees in special education are offered in the areas of behavior disorders, learning disabilities and mental retardation. The Master's degree in middle grades education includes either a concentration in language arts or social studies. The Ph.D. program in curriculum and instruction is primarily designed to prepare students for roles as researchers and educators in higher education, industry, or for instructional leadership at school district and state levels. The program is built on foundations of research and application and is composed of three strands: (1) content area specialization, (2) research, and (3) preparation for professional roles. Students can focus on the following areas of specialization: business and marketing education, curriculum development and supervision, educational psychology, elementary education, English and language arts education, instructional technology, middle grades education, reading education, social studies education, and special education.

Counselor Education: The Department also offers Master's degrees in counselor education: school counseling, student personnel in higher education (college counseling), and agency counseling. The Ph.D. degree program is offered in Counselor Education. The Council for Accreditation of Counseling and Related Educational Programs (CACREP), a specialized accrediting body recognized by the Council on Post-Secondary Accreditation (COPA), has conferred accreditation to all graduate programs in Counselor Education.

Admission Requirements: *Curriculum and Instruction:* A 500-800 word statement describing professional goals is required. Some areas of study require that applicants be qualified to hold a baccalaureate-level teaching license or that they have teaching experience. GRE scores not more than five years old are required for the doctoral program. GRE or MAT scores not more than five years old are required for the Master's program. *Counselor Education:* Requirements include a 3.00 average (4.00 scale) of the undergraduate program, and one year of work experience in a human service capacity. The best qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum grade-point average and work experience requirements may be made for students with special backgrounds, abilities and interests.

Master's Degree Requirements: *Curriculum and Instruction:* A minimum of 36 course credit hours and a written examination or culminating project are required. For the M. S. degree, a minimum of 39 hours is required. The M. S. degree requires a final oral examination and thesis approved by the graduate committee. *Counselor Education:* A minimum of 48 credits hours is required for the M.Ed degree. The M. S. degree requires completion of a total of 60 credits, including a thesis.

Doctoral Degree Requirements: *Curriculum and Instruction:* A minimum of 72 course credit hours is required, which includes 15-18 hours of research, a curriculum specialty, and 12 hours of dissertation credit. *Counselor Education*: A minimum of 62 credits hours beyond the Master's degree is required, including the courses in research, counselor education theory, a cognate area, and professional application.

Student Financial Support: No financial aid is available on a regular basis. The Counselor Education program works with the Division of Student Affairs to offer graduate assistantships.

GRADUATE COURSES

CURRICULUM AND INSTRUCTION

ECI 500 Theory and Practice in Teaching Diverse Populations
ECI 501 Foundations of Curriculum
ECI 502 Teaching through the Arts
ECI 503 Effective Teaching
ECI 504 Principles and Practices of Supervision
ECI(FL) 505 Issues and Trends in Foreign Language Education--Theory and Practice
ECI(FL) 506 Instructional Technology in Foreign Language Education
ECI 508 Teachers as Leaders
ECI 509 Special Problems in Curriculum and Instruction
ECI 510 Research Applications in Curriculum and Instruction
ECI 511 Computer Applications and Curriculum Integration
ECI 513 Videography in Education
ECI 514 Multimedia Design and Applications in Instruction

ECI 515 Internet Applications and Web Page Design in Instruction
ECI 516 Design and Evaluation of Instructional Materials
ECI 517 Advanced Multimedia Design and Applications in Instruction
ECI 518 Program and Staff Development in Instructional Technology
ECI 519 Special Problems in Instructional Technology
ECI 520 The Teaching of Composition
ECI 521 Teaching Literature for Young Adults
ECI 522 Trends and Issues in English Language Arts Education
ECI 523 Teacher as Researcher
ECI 524 Issues in Elementary School Teaching
ECI 525 Contemporary Approaches in the Teaching of Social Studies
ECI 526 Theory and Research on Teaching and Learning Social Studies
ECI 527 Special Problems in Social Studies
ECI 529 Special Problems in English Education
ECI 530 Social Studies in the Elementary School
ECI 532 Early Childhood Education
ECI 533 Language Arts in the Elementary School
ECI 539 Special Problems in Elementary School
ECI 540 Reading in the Elementary School
ECI 541 Reading in the Content Areas
ECI 542 Literacy Instruction for College Students: Research, Theory and Practice
ECI 543 Diagnosis of Reading Disabilities
ECI 544 Remediation of Reading Disabilities
ECI 545 Literacy Theory and Research
ECI 546 Literacy Instruction, Technology and Media
ECI 547 Teaching Children's Literature
ECI 549 Special Problems in Reading
ECI 550 Foundations of Middle Years Education
ECI 551 Teaching/Learning Approaches for Emerging Adolescents
ECI 559 Special Problems in Middle Years Education
ECI 560 Professional Development in Business and Marketing Education
ECI 561 Curriculum and Instruction in Business and Marketing Education
ECI 562 Program Management in Business and Marketing Education
ECI 566 Advanced Instructional Strategies in Business and Marketing
ECI 569 Special Problems in Business and Marketing Education
ECI 570 Learning Disabilities
ECI 571 Methods and Materials in Learning Disabilities
ECI 572 Resource Teaching in Special Education
ECI 573 Classroom Management in Special Education
ECI 574 Mental Retardation
ECI 575 Communication Disorders in the Classroom
ECI 576 Methods and Materials in Teaching Persons with Mental Retardation
ECI 577 Education of Severely Handicapped
ECI 578 Methods for Teaching the Gifted
ECI 580 Transition Program for Students with Mild Disabilities
ECI 581 Educational Diagnosis and Prescription for Children with Exceptionalities
ECI 582 Introduction to the Gifted Individual
ECI 583 Behavior Disorders
ECI 584 Methods and Materials: Behavior Disorders
ECI 585 Education of Exceptional Children
ECI 597 Special Problems in Special Education
ECI 601 Seminar
ECI 602 Seminar in Selected Topics in Curriculum and Instruction
ECI 603 Advanced Seminar in Literacy
ECI 604 Seminar in Conflict Resolution and Mediation in Schools
ECI 606/806 Seminar on Teacher as Learner: Developmental Theory, Research and Practice
ECI 607/807 Advanced Seminar in Multicultural Education
ECI 620 Special Problems
ECI 630 Independent Study in Curriculum and Instruction
ECI 640 Practicum in Curriculum and Instruction
ECI 641 Practicum in Mentoring of Teachers
ECI 642 Practicum I - Instructional Technology
ECI 643 Practicum in Social Studies
ECI 644 Practicum in Elementary Education
ECI 645 Diagnostic-prescriptive Practicum in Reading

ECI 646 Practicum in Middle Grades Education
ECI 647 Practicum in Business and Marketing Education
ECI 648 Practicum in Special Education
ECI 649 Practicum II - Instructional Technology
ECI 650 Internship in Curriculum and Instruction
ECI 651 Internship in Mentoring
ECI 652 Internship in Instructional Technology - Computers
ECI 653 Internship in Social Studies
ECI 654 Internship in Elementary Education
ECI 655 Internship in Reading Education
ECI 656 Internship in Middle Grades Education
ECI 657 Internship in Business and Marketing Education
ECI 658 Internship in Special Education
ECI 680 Directed Research in Curriculum and Instruction
ECI 685 Master's Supervised Teaching
ECI 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ECI 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ECI 690 Master's Examination
ECI 691 Research Applications in Curriculum and Instruction
ECI 692 Master's Research Projects
ECI 693 Master's Supervised Research
ECI 695 Master's Thesis Research
ECI 696 Summer Thesis Research
ECI 699 Master's Thesis Preparation
ECI 700 Curriculum Theory and Development
ECI 701 Foundations of Curriculum
ECI 705 Instructional Supervision of Teachers
ECI 709 Special Problems in Curriculum and Instruction
ECI 710 Research Applications in Curriculum and Instruction
ECI 711 Computer Applications and Curriculum Integration
ECI 714 Multimedia Design and Applications in Instruction
ECI 715 Internet Applications and Web Page Design in Instruction
ECI 716 Design and Evaluation of Instructional Materials
ECI 717 Advanced Multimedia Design and Applications in Instruction
ECI 718 Program and Staff Development in Instructional Technology
ECI 719 Special Problems in Instructional Technology
ECI 720 The Teaching of Composition
ECI 721 Teaching Literature for Young Adults
ECI 727 Special Problems in Social Studies Education
ECI 729 Special Problems in English Education
ECI 731 Teachers and the Elementary School Curriculum
ECI 739 Special Problems in Elementary Education
ECI 741 Reading in the Content Area
ECI 745 Literacy Theory and Research
ECI 746 Literacy Instruction, Technology and Media
ECI 747 Teaching Children's Literature
ECI 749 Special Problems in Reading Education
ECI 751 Teaching/Learning Approaches for Emerging Adolescents
ECI 759 Special Problems in Middle Years Education
ECI 769 Special Problems in Marketing Education
ECI 786 Introduction to Issues and Techniques in Visual Impairments
ECI 787 Orientation and Mobility of the Visually Impaired
ECI 788 Structure and Function of the Eye and Use of Low Vision
ECI 789 Teaching Braille and Communication Skills
ECI 790 Methods and Materials in Visual Impairments
ECI 797 Special Problems in Special Education
ECI 801 Seminar
ECI 802 Seminar in Curriculum and Instruction
ECI 803 Advanced Seminar in Literacy
ECI 804 Seminar on Attention Deficit Hyperactivity Disorder, Research and Treatment
ECI 806/606 Seminar on Teacher as Learner: Developmental Theory, Research and Practice
ECI 807/607 Advanced Seminar in Multicultural Education
ECI 820 Special Problems
ECI 830 Independent Study in Curriculum and Instruction
ECI 840 Practicum in Curriculum and Instruction

ECI 841 Practicum in Mentoring of Teachers
ECI 842 Practicum in Instructional Technology - Computers
ECI 843 Practicum in Social Studies
ECI 844 Practicum in Elementary Education
ECI 845 Diagnostic-Prescriptive Practicum in Reading
ECI 846 Practicum in Middle Grades Education
ECI 847 Practicum in Marketing Education
ECI 848 Practicum in Special Education
ECI 850 Internship in Curriculum and Instruction
ECI 851 Internship in Mentoring
ECI 852 Internship in Instructional Technology
ECI 853 Internship in Social Studies
ECI 854 Internship in Elementary Education
ECI 855 Internship in Reading Education
ECI 856 Internship in Middle Grades Education
ECI 857 Internship in Marketing Education
ECI 858 Internship in Special Education
ECI 880 Directed Study in Curriculum and Instruction
ECI 885 Doctoral Supervised Teaching
ECI 890 Doctoral Preliminary Examination
ECI 891 Research Applications in Curriculum and Instruction
ECI 892 Doctoral Research Projects
ECI 893 Doctoral Supervised Research
ECI 895 Doctoral Dissertation Research
ECI 896 Summer Dissertation Research
ECI 899 Doctoral Dissertation Preparation
EDP 504 Advanced Educational Psychology
EDP 560 Educational Testing and Measurement
EDP(PSY) 582 Adolescent Development
EDP 760 Quantitative Analysis in Education

COUNSELOR EDUCATION
ECD 510 Introduction to Counseling
ECD 524 Career Counseling and Development
ECD 525 Cross Cultural Counseling
ECD 530 Theories and Techniques of Counseling
ECD 533 Introduction to School Counseling
ECD 534 Guidance and Counseling in Elementary and Middle Schools
ECD 535 Student Development in Higher Education
ECD 536 Community Service Agencies
ECD 539 Group Counseling
ECD(WGS) 540 Gender Issues in Counseling
ECD 543 The American College Student
ECD 560 Research and Assessment in Counseling
ECD 590 Special Problems
ECD 620 Special Problems in Guidance
ECD 640 Prepracticum in Counseling
ECD 641 Introductory Practicum in Counseling
ECD 642 Practicum in Counseling
ECD 651 Internship in School Counseling
ECD 652 Internship in College Student Development
ECD 653 Internship in Agency Counseling
ECD 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ECD 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ECD 692 Master's Research Project
ECD 693 Master's Supervised Research
ECD 695 Master's Thesis Research
ECD 696 Summer Thesis Research
ECD 699 Master's Thesis Preparation
ECD 731 Career Development Theory and Research
ECD 733 Cognitive-Behavioral Theory, Research and Practice
ECD 735 Counseling Supervision: Theory and Research
ECD 737 Cognitive-Developmental Theory, Research and Practice
ECD 738 Research in Counselor Education

ECD 740 Advanced Psycho-Social Identity Development: Race, Gender and Culture
ECD 790 Special Problems
ECD 820 Special Problems
ECD 843 Advanced Counseling Practicum
ECD 847 Counseling Supervision: Practicum
ECD 850 Internship in Counselor Education
ECD 860 Professional Issues in Counseling
ECD 886 Supervised Practice Teaching in Counselor Education
ECD 890 Doctoral Preliminary Examination
ECD 892 Doctoral Research Project
ECD 893 Doctoral Supervised Research
ECD 895 Doctoral Dissertation Research
ECD 896 Summer Dissertation Research
ECD 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Design

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Design	Y						

GRADUATE FACULTY

Director of Graduate Programs:
M. J. Davis, Box 7701, 515.8335, meredith_davis@ncsu.edu, Graphic Design

Alumni Distinghuished Professor of Architecture: P. Tesar
Professor of Architecture: J. W. Place

Professors: M. J. Davis, H. Khachatoorian, R. C. Moore, A. R. Rice, M. Scotford; ***Professors Emeriti:*** F. A. Rifki; ***Associate Professors:*** C. Raub, K. Schaffer, J. O. Tector; ***Research Associate Professors:*** P. K. Baran, N. G. Cosco

The mission of the Doctor of Philosophy in Design Program in the College of Design at NC State University is to improve human condition through design research and scholarship. This mission is built in equal parts on the recognition of a fertile common ground among the design disciplines and on the need for specificity and depth within them. The Ph.D. Program therefore values a broad range of research interests that aim to improve the human condition through design.

The aim of the Ph.D. in design is to prepare students holding previous degrees in a design discipline to conduct research in the areas of: design for health and well-being; design for learning; design for sustainability; design and technology; design and the urban context; design methods; and design history and criticism.

Admission Requirements: Two official academic transcripts; three letters of reference; GRE scores; TOEFL scores (for international students); residency statement (U.S. residents only); College of Design personal data form; statement of research intent; and portfolio.

Doctoral Degree Requirements: The program of study requires a minimum of 54 credit hours of graduate work beyond the Master's degree, and of these credit hours, 18 will be independent research and dissertation credit with the remaining 36 hours of course work being completed in the Ph.D. program. In addition, there are three (3) 1-credit colloquia.

Student Financial Support: Teaching and research assistantships are available to several doctoral students, and in addition, those students receiving some form of research assistantship will also receive tuition remission. Assistantships are awarded on the recommendation of the admissions committee.

GRADUATE COURSES

DDN 701 Research Methods in Design
DDN 702 Research Paradigms in Design
DDN 770 Research in Information Design
DDN 771/GD 571 Design as Cognitive Artifact
DDN 772/GD 572 Design as Cultural Artifact
DDN 773/GD 573 New Information Environments
DDN 776/ARC(LAR) 576 Community Design
DDN 777/ARC(LAR) 577 Sustainable Communities
DDN 778/ARC(LAR) 578 Ecological Design
DNN 779/LAR 579 Human Use of the Urban Landscape

DDN 809 Dissertation Colloquium
DDN 830, 831 Information Design
DDN 885 Doctoral Supervised Teaching
DDN 890 Doctoral Preliminary Examination
DDN 893 Doctoral Supervised Research
DDN 895 Doctoral Dissertation Research
DDN 896 Summer Dissertation Research
DDN 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Economics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Agricultural and Resource Economics			Y				
Economics	Y			Y	Y		

GRADUATE FACULTY

Director of Graduate Programs:
D. J. Flath, Box 8110, 515.4617, david_flath@ncsu.edu, Economics

Hugh C. Kiger Professor: A. B. Brown
University Distinguished Professor: V. K. Smith
William Neal Reynolds Professor: B. K. Goodwin, M. K. Wohlgenant
William Neal Reynolds Professor of Agricultural and Resource Economics: M. L. Walden

Professors: S. G. Allen, J. A. Brandt, R. L. Clark, L. A. Craig, J. E. Easley Jr., E. A. Estes, D. J. Flath, T. J. Grennes, A. R. Hall, D. M. Holthausen Jr., D. N. Hyman, C. E. Joyner, C. R. Knoeber, J. S. Lapp, S. E. Margolis, M. C. Marra, R. B. Palmquist, D. K. Pearce, M. A. Renkow, C. D. Safley, J. J. Seater, L. O. Taylor, W. N. Thurman, T. Vukina, W. J. Wessels, G. A. Wossink; ***Research Professors:*** L. U. Hatch; ***Professors Emeriti:*** G. A. Carlson, L. E. Danielson, E. W. Erickson, D. Fisher, T. Johnson, C. L. Moore Sr., R. A. Schrimper; ***Associate Professors:*** D. S. Ball, G. A. Benson, M. Caner, P. L. Fackler, A. E. Headen Jr., A. Inoue, M. B. McElroy, C. M. Newmark, A. W. Oltmans, D. J. Phaneuf, N. E. Piggott, T. C. Tsoulouhas, K. D. Zering; ***Assistant Professors:*** P. Guerron, I. T. Kandilov, A. G. Leblebicioglu, D. Pelletier, R. M. Rejesus, R. H. von Haefen, X. Zheng; ***Adjunct Assistant Professors:*** T. P. Holmes, B. Hubbell, D. MacNair

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: R. H. Bernhard, D. A. Dickey; ***Associate Professors:*** J. C. Dutton, Jr.; ***Associate Professors Emeriti:*** E. A. McDermed

The economics graduate program is a joint program of the Department of Agricultural and Resource Economics and the Department of Economics. Emphasis is placed on economic theory and quantitative economic analysis and their application to economic problems. The major fields of specialization are: agricultural economics, econometrics, environmental/resource economics, industrial organization, international economics, labor economics and macro-monetary economics.

Admission Requirements: Minimum background for admission includes intermediate microeconomics and macroeconomics, at least one semester of calculus (two for Ph.D.) and undergraduate statistics. Some students are admitted conditional on their taking certain prerequisites. The submission of GRE scores is only required for students applying for financial aid.

Master's Degree Requirements: The Master of Science in agricultural and resource economics and the Master of Arts in economics require core courses in micro-economics (ECG 505 or ECG 700), macroeconomics (ECG 506 or ECG 703), statistics (ST 504) and applied econometrics (ECG 561). Both degrees have thesis and elective requirements. The Master of Economics is a non-thesis degree with two options: (1) Ph.D. Preparatory and (2) Applied Economics and Policy Analysis. Both options require a core of ECG 700 (or ECG 505), ECG 703 (or ECG 506), ST 514 and ECG 561. In addition ECG 765 is highly recommended for Option 1 while Option 2 also requires ECG 562. Both options have elective requirements. All three Master's degrees require a total of 30 credit hours. Accelerated Bachelor's/Master's degree programs are available for all three Master's

degrees.

Doctoral Degree Requirements: The Ph.D. program requires a minimum of 72 hours and at least six semesters of work beyond the Bachelor's degree. Students must pass written comprehensive examinations in micro-economics and macro-economics. Course requirements include two semesters of econometrics and six field courses.

Student Financial Support: Research and teaching assistantships are available and are awarded on a competitive basis. These assistantships go to Ph.D. students only; there is no financial support for Master's students. Prospective doctoral students who wish to be considered for assistantships are advised to apply for fall admission by the third week in January.

Other Relevant Information: Graduate students on financial support are provided office space or study carrels. Other students may be assigned study carrels if available. All students have access to the economics graduate student computer lab.

GRADUATE COURSES

ECG(PRT) 503 Economics of Recreation
ECG 504 Monetary and Financial Macroeconomics
ECG 505 Applied Microeconomic Analysis
ECG 506 Applied Macroeconomic Analysis
ECG 507 Economics for Managers
ECG 508 Macroeconomics and the Business Environment
ECG 512 Law and Economics
ECG 514 Economics of Information Goods
ECG 515 Environmental and Resource Policy
ECG 521 Markets and Trade
ECG 523 Planning Farm and Area Adjustments
ECG 532 Economics of Trade Unions
ECG 533 Economics of World Food and Agricultural Policy
ECG 537 Health Economics
ECG 540 Economic Development
ECG 551 Agricultural Production Economics
ECG 555 Managerial Economics
ECG(ST) 561 Intermediate Econometrics
ECG 562 Topics in Applied Econometrics
ECG 570 Analysis of American Economic History
ECG 580 Writing in Economics
ECG 590 Special Topics
ECG 630 Independent Study
ECG 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ECG 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ECG 690 Master's Examination
ECG 695 Master's Thesis Research
ECG 696 Summer Thesis Research
ECG 699 Master's Thesis Preparation
ECG 700 Fundamentals of Microeconomics
ECG 701 Microeconomics I
ECG 702 Microeconomics II
ECG 703 Fundamentals of Macroeconomics
ECG 704 Macroeconomics I
ECG 705 Macroeconomics II
ECG 706 Industrial Organization and Control
ECG 707 Topics in Industrial Organization
ECG 708 History of Economic Thought
ECG 710 Theory of Public Finance
ECG 715 Environmental and Resource Economics
ECG 716 Topics in Environmental and Resource Economics
ECG 730 Labor Economics
ECG 731 Policy and Research Issues in Labor Economics

ECG 739 Economic Growth and Development I
ECG 740 Economic Growth and Development II
ECG 741 Agricultural Production and Supply
ECG 742 Consumption, Demand and Market Interdependency
ECG 748 Theory of International Trade
ECG 749 Monetary Aspects of International Trade
ECG 750 Economic Decision Theory
ECG(ST) 751 Econometric Methods
ECG(ST) 752 Time Series Econometrics
ECG(ST) 753 Microeconometrics
ECG 765 Mathematical Methods for Economics
ECG 784 Advanced Macroeconomics
ECG 785 Monetary Economics
ECG 790 Advanced Special Topics
ECG 830 Independent Study
ECG 895 Doctoral Dissertation Research
ECG 896 Summer Dissertation Research
ECG 899 Doctoral Dissertation Preparation

Electrical and Computer Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Computer Engineering	Y		Y				
Electrical Engineering	Y		Y				

GRADUATE FACULTY

Director of Graduate Programs:
L. Lunardi, Box 7911, 513.7362, leda_lunardi@ncsu.edu, Electrical & Computer Engineering

Alcoa Professor of Electrical and Computer Engineering: A. Huang
Alton and Mildred Lancaster Distinguished Professor and Department Head: R. J. Trew
Distinguished Professor of Electrical and Computer Engineering: J. R. Hauser, N. A. Masnari
Distinguished University Professor: B. J. Baliga
Distinguished University Research Professor: D. L. Bitzer
Lampe Professor of Electrical and Computer Engineering: M. B. Steer
University Professor Emeritus: D. R. Rhodes

Professors: W. E. Alexander, S. M. Bedair, G. L. Bilbro, M. Chow, T. M. Conte, M. Devetsikiotis, A. Duel-Hallen, P. D. Franzon, J. J. Grainger, E. Grant, B. L. Hughes, G. J. Iafrate, K. W. Kim, R. M. Kolbas, H. Krim, L. Lunardi, T. K. Miller III, H. T. Nagle Jr., A. A. Nilsson, C. M. Osburn, M. C. Ozturk, S. A. Rajala, D. S. Reeves, G. N. Rouskas, W. E. Snyder, J. K. Townsend, H. J. Trussell, I. Viniotis, M. A. V. Vouk; ***Research Professors:*** W. C. Holton, J. F. Schetzina; ***Adjunct Professors:*** R. K. Cavin III, R. Luo, J. W. Mink, D. L. Woolard; ***Professors Emeriti:*** T. H. Glisson Jr., A. J. Goetze, M. A. Littlejohn, J. B. O'Neal Jr., A. Reisman, J. J. Wortman; ***Associate Professors:*** S. T. Alexander, M. E. Baran, J. J. Brickley, G. T. Byrd, A. G. Dean, W. W. Edmonson, G. Lazzi, V. Misra, T. L. Mitchell, F. Mueller, J. F. Muth, H. O. Ozturk, E. Rotenberg, M. W. White; ***Associate Professors Emeriti:*** G. F. Bland, W. C. Peterson; ***Assistant Professors:*** D. Barlage, S. Bhattacharya, H. Dai, W. R. Davis, M. Escuti, D. Y. Eun, K. Gard, M. Ghovanloo, K. A. Harfoush, X. Liu, S. Sair, D. Schurig, M. L. Sichitiu, Y. Solihin, J. M. Tuck III, W. Wang, D. G. Yu; ***Research Assistant Professors:*** J. M. Wilson; ***Adjunct Assistant Professors:*** L. J. Bottomley, R. J. Evans, Y. L. Jou, R. T. Kuehn, A. Montalvo, A. S. Morris III, A. J. Rindos III, J. C. Sutton III, J. Zavada; ***Interinstitutional Faculty:*** J. M. Conrad, J. H. Kim

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: D. E. Aspnes, J. Narayan, H. G. Perros; ***Associate Professors:*** M. F. M. Stallmann

Admissions Requirements: Admission to the M.S. program requires a B.S. in electrical engineering, computer engineering or computer science, and an overall undergraduate GPA of at least 3.25. The minimum acceptable TOEFL score for admission to the M.S. program is 230 (575). Admission is further limited by available room in the elected program of study. Meeting the minimum above requirements alone does not guarantee admission.

Admission to the Ph.D. program requires a B.S. or M.S. in electrical engineering, computer engineering or computer science with an overall GPA of at least 3.60. The minimum acceptable TOEFL score for admission to the Ph.D. program is 230 (575). Admission is further limited by available room in the elected program of study, and meeting the minimum requirements as given above does not guarantee admission.

Master's Degree Requirements: Thirty (30) credit hours; a thesis is optional. Students must have at least 21 hours of ECE courses that cover at least three specialty areas and have at least six credit hours of advanced-

level ECE courses. Students electing the Option B non-thesis option must meet core course requirements and have at least six credit hours of 600-level ECE courses.

Doctoral Degree Requirements: Approximately 42 credit hours are required beyond the M.S. degree or 72 credit hours beyond the B.S. degree. A minimum of 18 of the 42 credit hours or a minimum of 42 of the 72 credit hours must be in scheduled courses. Nine hours of graduate-level courses outside the major area are required.

The department wishes to evaluate a Ph.D. student's research potential as quickly as possible. Consequently, all Ph.D. students are required to pass a qualifying review before the end of their third semester of study. This review is based on the student's academic performance to date and the results of a project with one of their committee members. Results are presented to the committee in both written and oral form. Based on this review, the committee will decide if the student may continue in the Ph.D. program.

Student Financial Support: The department offers financial support to qualified students in the form of teaching assistantships, research assistantships, fellowships and tuition remission.

GRADUATE COURSES

ECE(CSC) 506 Architecture of Parallel Computers
ECE 511 Analog Electronics
ECE 513 Digital Signal Processing
ECE 514 Random Processes
ECE 515 Digital Communications
ECE 516 System Control Engineering
ECE(CSC) 517 Object-oriented Languages and Systems
ECE 520 Digital ASIC Design
ECE 521 Computer Design and Technology
ECE(BME) 522 Medical Instrumentation
ECE 523 Photonics and Optical Communications
ECE 528 Semiconductor Characterization
ECE 530 Physical Electronics
ECE 531 Principles of Transistor Devices
ECE 532 Principles of Microwave Circuits
ECE 538 Integrated Circuits Technology and Fabrication
ECE 540 Electromagnetic Fields
ECE 544 Design of Electronic Packaging and Interconnects
ECE 546 VLSI Systems Design
ECE 549 RF Design for Wireless
ECE 550 Power System Operation and Control
ECE 555 Computer Control of Robots
ECE 556 Agent-based Mechatronics Systems
ECE 557 Principles of MOS Transistors
ECE 561 Embedded System Design
ECE 566 Code Generation and Optimization
ECE(CSC) 570 Computer Networks
ECE(CSC) 573 Internetwork Protocols and Architectures
ECE(CSC) 575 Introduction to Wireless Networking
ECE(CSC) 576 Connection-Oriented Networks
ECE(CSC,OR) 579 Introduction to Computer Performance Modeling
ECE 582 Wireless Communications Systems
ECE 591 Special Topics in Electrical Engineering
ECE 592 Special Topics in Electrical and Computer Engineering
ECE 633 Individual Topics in Electrical Engineering
ECE 634 Individual Studies in Electrical Engineering
ECE 685 Master's Supervised Teaching
ECE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ECE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ECE 693 Master's Supervised Research
ECE 695 Master's Thesis Research
ECE 699 Master's Thesis Preparation

ECE 703 Integrated Bioelectronic Circuits
ECE 704 Logic Design for Testability
ECE 705 Memory Systems
ECE 706 Advanced Parallel Computer Architecture
ECE 712 Analog VLSI
ECE (MAE,TE) 717 Multivariate Linear Systems Theory
ECE 718 Computer-aided Circuit Analysis
ECE 719 Microwave Circuit Design Using Scattering Parameters
ECE 721 Advanced Microarchitecture
ECE 722 Electronic Properties of Solid-State Materials
ECE 723 Optical Properties of Semiconductors
ECE 724 Electronic Properties of Solid-State Devices
ECE 725 Quantum Engineering
ECE 726 Advanced Feedback Control
ECE(PY) 727 Semiconductor Thin Films Technology
ECE 729 Growth of Thin Films from the Vapor Phase
ECE 733 Digital Electronics
ECE 734 Switchmode DC-to-DC Converters
ECE 736 Power System Stability and Control
ECE 737 Characterization of High-speed Devices
ECE 739 Integrated Circuits Technology and Fabrication Laboratory
ECE 744 Design of Electronic Packaging and Interconnects
ECE 741 Sequential Machines
ECE 742 Artificial Neural Networks
ECE 743 High Performance Multicomputer Architecture
ECE 745 ASIC Verification
ECE 746 High Performance VLSI Design
ECE 747 Digital Signal Processing Architecture
ECE(CSC) 748 Parallel Processing
ECE 751 Detection and Estimation Theory
ECE 752 Information Theory
ECE 753 Computer Analysis of Large-scale Power Systems
ECE 755 Advanced Robotics
ECE 756 Advanced Mechatronics
ECE 759 Pattern Recognition
ECE 761 Design Automation for VLSI
ECE 762 Advanced Digital Communications Systems
ECE 763 Computer Vision
ECE 764 Digital Image Processing
ECE 765 Fault Tolerant Computing
ECE 766 Wireless Communications: Signal Processing Principles
ECE 767 Error-Control Coding
ECE(CSC) 773 Advanced Topics in Internet Protocols
ECE(CSC) 774 Advanced Network Security
ECE(CSC) 775 Advanced Topics in Wireless Networking
ECE(CSC) 776 Design and Performance Evaluation of Network Systems and Services
ECE(CSC) 777 Telecommunications Network Design
ECE(CSC) 778 Optical Networks
ECE(CSC) 779 Advanced Computer Performance Modeling
ECE 781 Special Studies in Electrical Engineering
ECE 782 Special Studies in Electrical Engineering
ECE 783 Computer Engineering Research Presentation
ECE 785 Topics in Advanced Computer Design
ECE 786 Topics in Advanced Computer Architecture
ECE 791 Special Topics in Electrical Engineering
ECE 792 Special Topics in Electrical Engineering
ECE 801 Seminar in Electrical and Computer Engineering
ECE 802 Seminar in Circuits and Systems
ECE 803 Seminar in Computer Engineering
ECE 804 Seminar in Communications and Signal Processing
ECE 805 Seminar in Solid State
ECE 833 Individual Topics in Electrical and Computer Engineering
ECE 834 Individual Studies in Electrical and Computer Engineering
ECE 885 Doctoral Supervised Teaching
ECE 890 Doctoral Preliminary Examination

ECE 893 Doctoral Supervised Research
ECE 895 Doctoral Dissertation Research
ECE 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Engineering - (Off-campus program only)

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Engineering (Off-campus, continental US residents and/or employees only)					Y		

GRADUATE FACULTY

Director of Graduate Programs:
L. D. Krute, Box 7901, 515.5440, linda_krute@ncsu.edu, Engineering Dean's Office

James T. Ryan Prof of Industrial Engineering: T. J. Hodgson

Professors: M. A. Barlaz, M. Chow, A. Duel-Hallen, Y. Fathi, P. D. Franzon, J. Genzer, R. D. Gould, C. S. Grant, D. W. Johnston, S. A. Khan, C. C. Koch, C. M. Osburn, M. R. Overcash, H. G. Perros, D. S. Reeves, P. I. H. Ro, G. N. Rouskas, R. O. Scattergood, H. J. Trussell; ***Professors Emeriti:*** C. F. Zorowski; ***Associate Professors:*** D. R. Cormier, T. L. Honeycutt, J. P. Lavelle, M. L. Leming

The College of Engineering offers a program leading to the Master of Engineering. This degree is primarily for individuals whose schedule or location does not allow on-campus study. Convenience and flexibility are the key advantages of this program. The students can take a variety of courses in different engineering fields and in computer science. This Option B program requires 30 credit hours and does not require GRE, thesis, final oral exam, or on-campus attendance. The Master of Engineering degree can be earned totally through the Engineering Online program. The Engineering Online program delivers credit courses in Engineering and in Computer Science directly to home or workplace via streaming media on the Internet. The on-line courses are the same as the on-campus courses in terms of content, requirements and academic rigor.

Each student in the Master of Engineering program must complete a minimum of three (3) courses from a single concentration area. The concentration area will appear on the student's transcript if a minimum of five (5) courses is taken in the designated concentration field. At least 18 hours of the minimum 30 hours required to satisfy the Master of Engineering degree requirements must be taken from a department in the College of Engineering. The concentration fields in the Master of Engineering are Chemical Engineering, Civil Engineering, Computer Science, Electrical and Computer Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical and Aerospace Engineering.

Admission Requirements: Prerequisites for admission to the Master of Engineering include an accredited undergraduate degree in engineering or physical sciences with a minimum overall GPA of 3.0.

GRADUATE COURSES

EGR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
EGR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

NCSU Graduate Catalog

English

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Creative Writing							Y
English				Y			
Technical Communication			Y				

GRADUATE FACULTY

A. H. Harrison, ***Department Head***

Directors of Graduate Programs:
C. A. Prioli, Box 8105, 515.4107, prioli@ncsu.edu, English, Creative Writing
R. S. Dicks, Box 8105, 513.7354, sdicks@unity.ncsu.edu, Technical Communication

SAS Distinguished Prof in Technical Communication & DPG, Communication, Rhetoric & Digital Media: C. R. Miller
William C. Friday Distinguished Professor and Interim Department Head of English: W. A. Wolfram

Professors: C. M. Anson, J. Balaban, M. P. Carter, B. D. Faber, J. A. Gomez, J. M. Grimwood, C. Gross, A. H. Harrison, M. T. Hester, H. Kellner, J. J. Kessel, T. D. Lisk, L. H. MacKethan, J. McCorkle, J. M. Nfah-Abbenyi, M. E. N. Orr, A. M. Penrose, C. A. Prioli, L. R. Severin, A. F. Stein, J. F. Thompson, M. H. Thuente, J. N. Wall Jr., R. V. Young Jr.; ***Professors Emeriti:*** B. J. Baines, G. W. Barrax, P. E. Blank Jr., L. S. Champion, J. W. Clark Jr., A. Davis-Gardner, J. D. Durant, M. Halperen, L. T. Holley, H. G. Kincheloe, A. S. Knowles, B. G. Koonce Jr., W. E. Meyers, F. H. Moore, J. J. Small, L. Smith, J. J. Smoot, W. B. Toole III, M. C. Williams, P. J. Williams; ***Associate Professors:*** W. W. Barnhardt, D. H. Covington, R. S. Dicks, N. Halpern, S. M. Katz, R. C. Kochersberger Jr., L. S. May, S. Miller-Cochran, J. D. Morillo, J. Packer, M. T. Pramaggiore, S. M. Setzer, W. P. Shaw, S. Smith McKoy, J. Swarts, E. R. Thomas, C. A. Warren, D. B. Wyrick; ***Associate Professors Emeriti:*** E. P. Dandridge Jr., H. A. Hargrave, M. F. King, C. E. Moore, N. G. Smith, H. C. West; ***Assistant Professors:*** A. Baker, B. Bennett, B. M. Blackley, A. Bolonyai, J. Charles, R. M. Dodsworth, M. K. Dudley, D. A. Hooker, J. Miller, D. Orgeron, M. Orgeron, J. L. Reaser, D. J. Reavis, D. M. Rieder, M. L. Welch; ***Visiting Assistant Professors:*** S. Joffe

MASTER OF ARTS (MA)

The Master of Arts program offers instruction in English and American literature, world literature, film studies, rhetoric and composition, and linguistics. It can serve either as a complete course of study or as the first phase of study toward a doctoral degree at another institution.

Admission Requirements: Overall GPA of 3.0 or higher. Applicants should submit GRE scores (general aptitude and analytical writing); one official transcript of all undergraduate and graduate work; three letters of recommendation; a personal statement; and a writing sample. Creative writing applicants should submit both a creative and a critical writing sample.

Requirements for MA in English: The program requires 32 credit hours. All students, except those in the linguistics and film studies concentrations, take a distribution of four courses, one each in English literature before 1660, English literature after 1660, American literature and a fourth category including composition theory, rhetoric, linguistics, or literary theory. Linguistics students take two literature classes of their choice to fulfill the distribution requirement. In addition, all students must take an introduction to research and bibliography, pass a foreign language requirement, write a thesis and pass an oral exam on the thesis research.

Beyond these basic requirements, the program comprises five concentrations in English and American literature, film studies, composition and rhetoric, world literature, and linguistics. Each concentration requires five additional courses, of which three must pertain to the area of concentration. The thesis likewise will be written in the area of the concentration and directed by a specialist in the field.

Student Financial Support: Teaching assistantships are available for a limited number of promising students. Applications for assistantships are due February 1 for those entering in the fall, and November 1 for those entering in the spring. (New assistantships are rarely available for the spring semester.) During their first year those selected to teach composition must take ENG 511 (Theory and Research in Composition), be mentored by a composition instructor, and attend a second workshop before their second year. These duties receive credit as ENG 685 (Master's Supervised Teaching), but do not fulfill requirements for the degree.

Other Relevant Information: For students who hold initial licensure from the NC Department of Public Instruction, the department offers the MA with advanced licensure requiring 24 semester hours of graduate credit in English and 15 semester hours of graduate credit in Education. Students and faculty in the Department of English are eligible for fellowships to participate in programs sponsored by the Folger Institute of Renaissance and Eighteenth-Century Studies, which is located in Washington, DC, at the Folger Shakespeare Library.

TECHNICAL COMMUNICATION (MS)

The Master of Science in technical communication is designed to prepare professional communicators for advanced positions in industry and research organizations; with appropriate electives, students can prepare for careers in web design and development, software documentation, environmental communication, medical writing, industrial training in writing and editing, publications management and related areas.

Admission Requirements: Applicants should submit a resume and a writing sample. Prerequisites for the program are basic editing and technical writing (ENG 214, ENG 314 or 331, 332, or 333) or equivalent courses and/or work experience. The application deadline is June 15 for the fall semester and November 1 for the spring semester. Those who wish to be considered for teaching assistantships should complete the application by February 1 for fall.

Requirements for MS in Technical Communication: The program requires 33 semester hours: 15 hours in the fields of technical writing, publication management, rhetoric and a projects course; the remaining hours are taken in applications, theory and methods and cross-disciplinary courses. Students must also satisfy a requirement for one semester of professional work experience.

Student Financial Support: Teaching assistantships are available for a limited number of promising students. These students work with an experienced teacher in their first year to assist in 300-level writing courses. They devote half time in subsequent semesters to teaching technical communication.

CREATIVE WRITING (MFA)

The Department of English offers a two-year studio/academic program in fiction or poetry leading to the Master of Fine Arts degree. The program provides an opportunity for students of superior and demonstrated ability in imaginative writing to develop their skills and critical judgment through the practice of writing and the study of literature. The aim of the program is to prepare talented students for careers in writing. Degree candidates are expected to produce a book-length work of literary value and publishable quality.

Admission Requirements: Overall GPA of 3.0 or higher; applicants should submit GRE scores (general aptitude and analytical writing); one official transcript of all undergraduate and graduate work; three letters of recommendation; and two writing samples, one creative, one critical. Creative sample: for fiction, two short

stories, or for a novel, three chapters (or one chapter and a short story) totaling 25-40 pages; for poetry, 12 complete poems. Critical sample: no more than 15 pages of writing demonstrating your ability to succeed in graduate-level literature classes, a required part of the MFA curriculum

Requirements for the MFA in Creative Writing: Candidates for the MFA degree must complete a total of 36 credits. Eighteen of these are taken in the area of writing specialization. These include workshop courses (12 credits) and thesis (6 credits). The remaining credits are taken in literature and directed readings (12 credits), elective (3 or 6 credits), and, for those on a composition teaching assistantship, ENG 511, Theory and Research in Composition (3 credits).

In their final semester, students must pass a comprehensive written examination on writing craft, based on a book list selected jointly by the student and the faculty. The final thesis must be a book-length manuscript in the student's field of interest. In fiction, an approximate 200 pages are expected; in poetry, 60 pages.

Student Financial Support: Teaching assistantships are available for a limited number of promising students. Selected new Teaching Assistants are also eligible for fellowship money awarded as an increase in assistantship stipend. TAs in the MFA train to teach undergraduate creative writing classes or composition classes.

Other Relevant Information: Application deadline is April 1 for both U.S. and international students; February 1 for those seeking assistantships. Students are admitted for the fall semester only.

The English department has a long tradition of academic and literary excellence, including its heritage of writers from Guy Owen to Lee Smith, its publishing of the *Southern Poetry Review, The John Donne Journal, Free Verse,* and *Obsidian*. The strength of NCSU in the sciences offers students the opportunity to do creative work that engages with issues of technology and its effect on individuals and institutions that are not typically addressed in fine arts programs.

Through its Owen/Walters Readings Series, the department sponsors readings and residencies by distinguished poets, fiction and non-fiction writers, and has initiated a semester-long Visiting Distinguished North Carolina Writers program.

GRADUATE COURSES

ENG 507 Writing for Health and Environmental Sciences
ENG 508 Usability Studies for Technical Communication
ENG 509 Old English Literature
ENG 510 Middle English Literature
ENG 511 Theory and Research in Composition
ENG 512 Theory and Research in Professional Writing
ENG 513 Empirical Research in Composition
ENG(COM) 514 History of Rhetoric
ENG 515 Rhetoric of Science and Technology
ENG(COM) 516 Rhetorical Criticism: Theory and Practice
ENG 517 Advanced Technical Writing, Editing and Document Design
ENG 518 Publication Management for Technical Communicators
ENG 519 Online Information Design and Evaluation
ENG 520 Science Writing for the Media
ENG 521 Modern English Usage
ENG 522 Linguistics and Literacy
ENG 523 Language Variation Research Seminar
ENG 524 Introduction to Linguistics
ENG 525 Variety in Language
ENG 526 History of the English Language
ENG 527 Discourse Analysis
ENG 528 Language Change Research Seminar
ENG 529 16th-century Non-dramatic English Literature
ENG 530 17th-century English Literature

ENG 531 American Colonial Literature
ENG 532 Narrative Analysis
NEG 533 Bilingualism and Language Contact
ENG(FL) 539 Seminar in World Literature
ENG 540 History of Literary Criticism
ENG(FL) 541 Critical Approaches to Literature and Culture
ENG 548 African-American Literature
ENG 549 Modern African Literature
ENG 550 English Romantic Period
ENG 551 Chaucer
ENG 555 American Romantic Period
ENG 558 Studies in Shakespeare
ENG 560 Victorian Poetry and Critical Prose
ENG 561 Milton
ENG 562 18th-century English Literature
ENG 563 18th-century English Novel
ENG 564 Victorian Novel
ENG 565 American Realism and Naturalism
ENG 570 20th-century British Prose
ENG 571 20th-century British Poetry
ENG 572 Modern British Drama
ENG 573 Modern American Drama
ENG 574 Comparative Drama
ENG 575 Southern Writers
ENG 576 20th-century American Poetry
ENG 577 20th-century American Prose
ENG 578 English Drama to 1642
ENG 579 Restoration and 18th-century Drama
ENG 580 Literary Postmodernism
ENG 582 Studies in Literature
ENG 583 Studies in Composition and Rhetoric
ENG 584 Studies in Linguistics
ENG 585 Studies in Film
ENG 586 Studies in Theory
ENG 587 Film and Visual Theory
ENG 588 Fiction Writing Workshop
ENG 589 Poetry Writing Workshop
ENG 590 Studies in Creative Writing
ENG 591 Studies in National Cinemas
ENG 624 Teaching College Composition
ENG 626 Advanced Writing for Empirical Research
ENG 636 Directed Readings
ENG 666 Teaching Methods for Professional Writing
ENG 669 Bibliography and Methodology
ENG 675 Projects in Technical Communication
ENG 685 Master's Supervised Teaching
ENG 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ENG 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ENG 693 Master's Supervised Research
ENG 695 Master's Thesis Research
ENG 696 Summer Thesis Research
ENG 699 Master's Thesis Preparation
ENG 798 Special Topics in English Studies
ENG 810 Directed Readings in English Studies

Entomology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Entomology	Y		Y		Y		

GRADUATE FACULTY

J. D. Harper, ***Department Head***

Director of Graduate Programs:
F. P. Hain, Box 7613, 515.3804, fred_hain@ncsu.edu, Entomology

Blanton J. Whitmire Distinguished Professor: C. Schal
Charles G. Wright Professor: J. Silverman
Philip Morris Professor: J. W. Van Duyn
William Neal Reynolds Professor: C. S. Apperson, F. L. Gould, G. G. Kennedy
William Neal Reynolds Professor of Entomology and Toxicology: R. M. Roe

Professors: J. T. Ambrose, J. S. Bacheler, J. R. Bradley Jr., R. L. Brandenburg, F. P. Hain, J. D. Harper, J. R. Meyer, R. E. Stinner, J. F. Walgenbach, B. M. Wiegmann; ***Adjunct Professors:*** J. J. Arends, A. C. Cohen, G. Gordh, N. M. Hamon, D. M. Jackson, D. E. Sonenshine; ***Professors Emeriti:*** R. C. Axtell, J. R. Baker, W. M. Brooks, W. V. Campbell, L. L. Deitz, M. H. Farrier, R. J. Kuhr, H. B. Moore Jr., H. H. Neunzig, R. L. Robertson, K. A. Sorensen, P. S. Southern, C. G. Wright; ***Associate Professors:*** D. B. Orr, C. E. Sorenson, E. L. Vargo, D. W. Watson; ***Adjunct Associate Professors:*** S. Bloem, K. S. Hedlund, D. A. Herbert Jr., K. R. Lakin, C. A. Nalepa, A. A. Perez de Leon, R. Sequeira, J. W. Smith; ***Associate Professors Emeriti:*** R. C. Hillmann; ***Assistant Professors:*** M. R. Abney, H. J. Burrack, Y. J. Cardoza, A. R. Deans, C. M. Grozinger, D. R. Tarpy, M. G. Waldvogel; ***Adjunct Assistant Professors:*** C. Devorshak

ASSOCIATE MEMBERS OF THE PROGRAM

Associate Professors: W. G. Buhler, D. J. Robison

Course offerings or research facilities are available in the following areas: agricultural entomology, apiculture, behavior, biological control, ecology, forest entomology, functional genomics, host-plant resistance, insect pathology, medical and veterinary entomology, pest management, physiology, molecular biology, population dynamics, urban entomology, systems analysis, systematics and toxicology.

Admission Requirements: A minimum score of 1000 (verbal plus quantitative) is necessary for admission to the M.E. or M.S. program while a score of 1100 is required for the Ph.D. program. Students are expected to have a background in biology in addition to appropriate courses in chemistry, biochemistry, mathematics and physics. A "B" average (3.0 GPA) is required in biology courses and an overall 3.0 GPA during the last two years of the undergraduate program.

Master's Degree Requirements: A minimum of 30 credits are required for graduation. Two core courses are required (Insect Systematics, and Insect Morphology and Physiology), however students may fulfill the requirement for either of these courses by passing a proficiency exam. In addition, six credits of letter grade entomology courses and two credits of entomology student seminars are also required.

Doctoral Degree Requirements: A minimum of 72 credits (18 may be transferred from a Masters degree) are required for graduation. Two core courses are required (insect Systematics, and Insect Morphology and

Physiology), however students may fulfill the requirement for either of these courses by passing a proficiency exam. In addition, nine credits of letter grade entomology courses and three credits of entomology student seminars are also required.

Student Financial Support: Graduate assistantships and other forms of aid are available to students as described in the Fellowships and Graduate Assistantships section of the Graduate Catalog.

Other Relevant Information: Admission is permitted only after acceptable applicants have secured an advisor and appropriate financial support. All students are expected to begin their research as soon as possible.

GRADUATE COURSES

ENT 501 Advanced Beekeeping
ENT 502 Insect Systematics
ENT 503 Insect Morphology and Physiology
ENT(ZO) 509 Ecology of Stream Invertebrates
ENT 525 Entomology for Educators
ENT 550 Fundamentals of Insect Control
ENT(ZO) 582 Medical and Veterinary Entomology
ENT 601 Seminar
ENT 604/804 Insect Natural History and Field Ecology
ENT 620 Special Problems
ENT 641 Agricultural Entomology Practicum
ENT 685 Master's Supervised Teaching
ENT 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ENT 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ENT 690 Master's Examination
ENT 693 Master's Supervised Research
ENT 695 Master's Thesis Research
ENT 696 Summer Thesis Research
ENT 699 Master's Thesis Preparation
ENT 720 Insect Pathology
ENT(TOX) 722 Insecticide Toxicology
ENT 726 Biological Control of Insects and Weeds
ENT 731 Insect Ecology
ENT 741 Immature Insects
ENT 762 Insect Pest Management in Agricultural Crops
ENT(FOR) 765 Advanced Forest Entomology
ENT 791 Special Topics in Entomology
ENT 801 Seminar
ENT 804/604 Insect Natural History and Field Ecology
ENT 820 Special Problems
ENT 841 Agricultural Entomology Practicum
ENT 885 Doctoral Supervised Teaching
ENT 890 Doctoral Preliminary Examination
ENT 893 Doctoral Supervised Research
ENT 895 Doctoral Dissertation Research
ENT 896 Summer Dissertation Research
ENT 899 Doctoral Dissertation Preparation

Fiber and Polymer Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Fiber and Polymer Science	Y						

GRADUATE FACULTY

Director of Graduate Programs:
W. Oxenham, Box 8301, 515.6573, william_oxenham@ncsu.edu, College of Textiles

Burlington Industries Professor of Textile Technology: R. L. Barker
Camille Dreyfus Professor: H. B. Hopfenberg
Charles A. Cannon Professor of Textiles: S. K. Batra
Ciba-Geigy Distinguished Professor and Associate Dean for Research: H. S. Freeman
Director of Graduate Programs and Abel C. Linberger Prof. of Yarn Manufacturing: W. Oxenham
Howard J. Schaeffer Distinguished University Professor: B. M. Novak
Klopman Distinguished Professor Emeritus: S. C. Winchester, Jr.
Kosa Professor of Fiber and Polymer Chemistry: A. E. Tonelli
Professor (Dean) and Joseph D. Moore Professorship of Textile and Apparel Management: A. B. Godfrey
William A. Klopman Distinguished Professor: B. Pourdeyhimi

Professors: C. M. Balik, K. R. Beck, C. L. Bumgardner, N. L. Cassill, T. G. Clapp, R. A. Donaldson, R. E. Fornes, T. K. Ghosh, C. B. Gorman, B. S. Gupta, H. Hamouda, P. J. Hauser, S. M. Hudson, W. J. Jasper, S. A. Khan, M. W. King, T. J. Little, J. P. Rust, A. M. Seyam, M. W. Suh; ***Professors Emeriti:*** D. R. Buchanan, J. A. Cuculo, A. H. M. El-Shiekh, P. L. Grady, S. P. Hersh, C. D. Livengood, R. McGregor, G. N. Mock, M. H. M. Mohamed, H. G. Olf, S. T. Purrington, C. B. Smith, E. O. Stejskal, W. C. Stuckey Jr., M. H. Theil, C. Tomasino, P. A. Tucker Jr., C. F. Zorowski; ***Associate Professors:*** P. Banks-Lee, K. T. Barletta, H. H. A. Hergeth, D. Hinks, G. L. Hodge, C. L. Istook, J. A. Joines, R. E. Kotek, T. M. Lamar, M. G. McCord, S. Michielsen, O. J. Rojas, R. Shamey, G. W. Smith, R. A. Venditti; ***Assistant Professors:*** R. E. Gorga, M. R. Jones, W. E. Krause, E. G. Loboa, M. Pasquinelli, X. Zhang; ***Visiting Assistant Professors:*** E. Shim, H. Vahedi Tafreshi

Fiber and Polymer Science is a multidisciplinary program bringing together the disciplines of mathematics, chemistry and physics and the application of engineering principles for the development of independent scholars versed in all aspects of fiber materials science. Thus, fiber and polymer science is concerned with the formation of and the mechanical, physical and chemical properties of polymeric materials, fibers produced from them, fiber assemblies in one-, two- and three-dimensional forms, and fiber reinforced composites, as well as the utilization thereof.

Admission Requirements: Students majoring in the physical sciences, engineering, mathematics, textiles and having a Master's degree will normally qualify for admission. For exceptionally qualified students, the Master's degree requirement may be waived, and the student can be admitted directly into the Ph.D. program.

Doctoral Degree Requirements: Credit-hour requirements for the Doctor of Philosophy degree are 72. (Up to 18 hours from an M.S. may be applied against the 72.) Students are admitted to candidacy for the Ph.D. degree after passing a series of written cumulative examinations, completing a scholarly critique of existing knowledge in the field of specialization, and orally defending a research proposal. A written examination in a minor field may be accepted in place of the scholarly critique. They must also have passed an English technical writing course during their college career.

Student Financial Support: Financial aid in the form of assistantships and fellowships is normally available for all U.S. full-time students. Financial aid in the form of Graduate Research/Teaching Assistantships may be available to a limited number of international students.

COURSE OFFERINGS (Extensive use may be made of graduate course offerings in other colleges on campus when developing the minor field.)

GENERAL COURSES

FPS(TT) 720 Yarn Production/Properties: Advanced Topics
FPS(TTM) 730 Measurement and Evaluation of Textile Properties
FPS(TT) 750 Advances in Woven Fabric Formation and Structure
FPS(TT) 781 Mechanics of Twisted Structures
FPS(TT) 782 Mechanics of Fabric Structures
FPS(TC) 792 Special Topics in Fiber Science
FPS 801 Seminar
FPS 830 Independent Study
FPS 876 Special Projects in Fiber and Polymer Science
FPS 885 Doctoral Supervised Teaching
FPS 890 Doctoral Preliminary Examination
FPS 893 Doctoral Supervised Research
FPS 895 Doctoral Dissertation Research
FPS 896 Summer Dissertation Research
FPS 899 Doctoral Dissertation Preparation
TC 704 Fiber Formation--Theory and Practice
TC(CH,MSE) 762 Physical Chemistry of High Polymers--Bulk Properties
TC 791 Special Topics in Textile Science
TMS 500 Fiber and Polymer Microscopy
TMS 761 Mechanical and Rheological Properties of Fibrous Material
TMS 762 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures
TMS(MSE) 763 Characterization of Structure of Fiber Forming Polymers

COURSES IN AREAS OF SPECIALIZATION

Polymer Chemistry and Synthesis
TC 530 The Chemistry of Textile Auxiliaries
TC(MSE) 561 Organic Chemistry of Polymers
TC 720 Chemistry of Dyes and Color
TC 721 Dye Synthesis Laboratory

Polymer Physics and Physical Chemistry
TC 704 Fiber Formation--Theory and Practice
TC 705 Theory of Dyeing
TC(CH,MSE) 762 Physical Chemistry of High Polymers--Bulk Properties
TC(CHE) 769 Polymers, Surfactants and Colloidal Materials
TC(CH,MSE) 772 Physical Chemistry of High Polymers--Solution Properties
TC(CHE) 779 Diffusion in Polymers
TC 792 Special Topics in Fiber Science
TMS 500 Fiber and Polymer Microscopy

Mechanics of Textile Materials and Processes
FPS(TT) 781 Mechanics of Twisted Structures
FPS(TT) 782 Mechanics of Fabric Structures
TE 565 Textile Composites
TT 500 Understanding the Textile Complex
TT 503 Materials, Polymers, and Fibers used in Nonwovens
TT 504 Introduction to Nonwovens Processes and Products
TT 505 Advanced Nonwovens Processing
TT 506 Bonding Principles in Nonwovens
TT 507 Nonwoven Characterization Methods
TT 508 Nonwoven Product Development

TT 520 Yarn Processing Dynamics
TT(TE,TMS) 521 Filament Yarn Production Processing and Properties
TT 549 Warp Knit Engineering and Structural Design
TT 550 Production Mechanics and Properties of Woven Fabrics
TT 551 Advance Woven Fabric Design & Structure
TT 552 Formation, Structure and Assembly of Medical Textile Products
TT 570 Textile Digital Design and Technology
TT 571 Professional Practices in Textile Design and Technology
TT 581 Technical Textiles
TT 591 Special Studies in Textile Technology
TT(FPS) 720 Yarn Production Properties: Advanced Topics

NCSU Graduate Catalog

Fisheries and Wildlife Sciences

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Fisheries and Wildlife Sciences	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
R. A. Lancia, Box 7646, 515.7586, richard_lancia@ncsu.edu, Fisheries and Wildlife

Professors: R. D. Brown, J. E. Easley Jr., D. B. Eggleston, E. C. Franklin, J. F. Gilliam, E. J. Jones, R. A. Lancia, J. F. Levine, T. M. Losordo, J. M. Miller, K. H. Pollock, R. A. Powell, J. A. Rice, M. K. Stoskopf, C. V. Sullivan; ***Research Professors:*** S. Kennedy-Stoskopf; ***Professors (USDI/USFS):*** J. A. Collazo, J. E. Hightower, T. R. Simons; ***Adjunct Professors:*** J. G. Rogers; ***Professors Emeriti:*** G. T. Barthalmus, P. T. Bromley, B. J. Copeland, R. L. Noble; ***Associate Professors:*** R. J. Borski, J. A. Buckel, W. G. Cope, H. V. Daniels, L. A. Degernes, J. Godwin, N. M. Haddad, G. R. Hess, J. M. Hinshaw, C. E. Moorman, C. E. Sorenson; ***Associate Professors (USDI/USFS):*** T. J. Kwak; ***Adjunct Associate Professors:*** W. G. Dorgeloh; ***Assistant Professors:*** C. S. DePerno, S. A. C. Nelson, R. Richardson; ***Research Assistant Professors:*** C. A. Harms; ***Adjunct Assistant Professors:*** D. T. Cobb, R. W. Heise

The fisheries and wildlife sciences degrees are offered through the Fisheries and Wildlife Sciences program, an intercollegiate program administered by the Department of Forestry and Environmental Resources and shared with the Department of Zoology and the College of Veterinary Medicine. Students are affiliated with the department of their major professor. The degrees emphasize assessment, biology, ecology and management of fish and wildlife species and their habitats.

Admissions Requirements: Application for admission is made directly to the Fisheries and Wildlife Sciences program. Minimum requirements include an undergraduate grade point average of 3.0 in an appropriate biological discipline and a graduate record examination score of 1000, calculated as the sum of verbal and quantitative scores. Admission is competitive and depends on the willingness of a member of the faculty to serve as major professor. Exceptions to minimum requirements may be made for students with special backgrounds.

Master's Degree Requirements: The M.S. degree program requires a minimum of 30 credit hours, including 1-2 hours of seminar and no more than six hours of research. A research-based thesis is required, as is a minor (usually 9-10 hours). The Master of Fisheries and Wildlife Sciences degree requires a minimum of 36 credits, including 4-6 hours of special problems and 1-2 hours of seminars. A professional paper is required. For either degree, further requirements may be imposed by the advisory committee and/or department.

Doctoral Degree Requirements: The Ph.D. program requires 36 to 54 credits of course work beyond the Master's degree, including two seminars and an ethics course, and a dissertation. Exceptionally well-prepared students may petition to have their degree objective changed to Ph.D. before completing the Master's degree.

Student Financial Support: Graduate research and teaching assistantships are offered for qualified students through participating departments. Commitments for assistantships are normally made at the time of admission to graduate study.

Other Relevant Information: Research near campus is facilitated by excellent field, laboratory and computer resources. Off-campus research is conducted at the Pamlico Aquaculture Field Laboratory, research and extension centers in eastern and western NC, The Center for Marine Sciences and Technology in Morehead

City, Bull Neck Swamp, Hill and Hofmann Forests, and at facilities of state and federal agencies and private organizations. For additional information, see the Fisheries and Wildlife Sciences graduate web page: http://cnr.ncsu.edu/fer/grads/gradfw.html

GRADUATE COURSES

FW(ZO) 515 Fish Physiology
FW(ZO) 553 Principles of Wildlife Science
FW(ZO) 554 Wildlife Field Studies
FW 560 International Wildlife Management and Conservation
FW(FOR) 585 Advanced Wildlife Habitat Management
FW(ZO) 586 Aquaculture I
FW(ZO) 587 Aquaculture I Laboratory
FW 595 Special Topics in Fisheries and Wildlife Sciences
FW(FOR) 602 Seminar in Wildlife Management.
FW 610 Special Topics in Fisheries and Wildlife Sciences
FW 685 Master's Supervised Teaching
FW 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
FW 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
FW 690 Master's Examination
FW 693 Master's Supervised Research
FW 695 Master's Thesis Research
FW 696 Summer Thesis Research
FW 699 Master's Thesis Preparation
FW 726 Quantitative Fisheries Management
FW 730 Ethics in Fisheries and Wildlife Sciences
FW 801 Issues in Fisheries and Wildlife Sciences Doctoral Seminar
FW 802 Seminar in Fisheries and Wildlife
FW 810 Special Topics in Fisheries and Wildlife
FW 885 Doctoral Supervised Teaching
FW 890 Doctoral Preliminary Exam
FW 893 Doctoral Supervised Research
FW 895 Doctoral Dissertation Research
FW 896 Summer Doctoral Dissertation Research
FW 899 Doctoral Dissertation Preparation

COURSES FROM ASSOCIATED DEPARTMENTS

ZO 501 Ornithology
ZO(ENT) 509 Ecology of Stream Invertebrates
ZO 519 Limnology
ZO 542 Herpetology
ZO 544 Mammalogy
ZO(MEA) 550 Principles of Biological Oceanography
ZO 603 Aquatic Ecology Seminar
ZO(ST) 710 Sampling Animal Populations
ZO 721 Fishery Science
ZO(MEA) 756 Ecology of Fishes
ZO 784 Advanced Topics in the Study of Mammals
ZO 789 Advanced Limnology

NCSU Graduate Catalog

Food Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Food Science	Y		Y		Y		

GRADUATE FACULTY

D. R. Ward, ***Department Head***

Director of Graduate Programs:
J. C. Allen, Box 7624, 513.2257, jon_allen@ncsu.edu, Food Science

William Neal Reynolds Professor: K. R. Swartzel
William Neal Reynolds Professor and University Distinguished Professor: T. R. Klaenhammer
William Neal Reynolds Professor Emeritus: H. E. Swaisgood
William Neal Reynolds Professor of Food Science: E. A. Foegeding

Professors: J. C. Allen, L. C. Boyd, G. L. Catignani, B. E. Farkas, D. P. Green, L. Jaykus, C. J. Lackey, T. C. Lanier, D. K. Larick, J. L. Oblinger, J. E. Rushing, J. D. Sheppard, L. G. Turner, D. R. Ward; ***Professors (USDA):*** R. F. McFeeters, T. H. Sanders; ***Adjunct Professors:*** A. Kilara, Y. Pan, R. C. Theuer; ***Professors Emeriti:*** L. W. Aurand, H. R. Ball Jr., R. E. Carawan, D. E. Carroll Jr., H. P. Fleming, M. E. Gregory, A. P. Hansen, M. W. Hoover, V. A. Jones, D. H. Pilkington, S. J. Schwartz, W. M. Walter Jr.; ***Associate Professors:*** S. L. Ash, C. R. Daubert, M. Drake, S. Kathariou, K. P. Sandeep, V. Truong; ***Adjunct Associate Professors:*** K. M. Keener; ***Assistant Professors:*** A. Amezquita, F. M. Arritt III, D. J. Hanson, G. K. Harris, T. G. Phister; ***Assistant Professors (USDA):*** F. Breidt, J. P. Davis, L. L. Dean, I. Diaz-Muniz

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: K. E. Anderson, S. A. Hale, H. M. Hassan, T. J. Hoban, S. A. Khan, B. W. Sheldon; ***Assistant Professors:*** R. Sharma

The department's professional activities include teaching, research, and extension functions. The program provides an educational, research, and informational center in food science for North Carolina and the nation. The department also houses two research centers, the Southeast Dairy Foods Research Center and the Center for Advanced Processing and Packaging Studies. Course offerings and research facilities are available in the following areas: chemistry-biochemistry, engineering, microbiology, nutrition and processing technology.

Admissions Requirements: To be admitted, a student should be a graduate of an accredited program in food science or the equivalent. Graduates of other majors can be admitted but will be required to make up certain undergraduate deficiencies without graduate credit. The best qualified applicants will be accepted up to the number of spaces that are available for new students.

Master's Degree Requirements: A Master's program must include courses from at least two of the following categories: chemistry-biochemistry, engineering, microbiology, nutrition and processing technology. The M. S. in Food Science requires 30 credit hours and the Master of Food Science requires 36 credit hours of course work.

Doctoral Degree Requirements: A doctoral program must include courses from at least three of the categories listed above (or equivalent courses at another university). Total course credits will vary depending on the needs of the student and the requirements of the Graduate School. All doctoral students are required to pass a

departmentally administered written preliminary exam, designed to evaluate a Ph.D. student's general knowledge and comprehension of food science.

Student Financial Support: Graduate assistantships and other forms of student aid available to students in this program are described elsewhere in the Graduate Catalog. Admission does not guarantee availability of financial support.

Other Relevant Information: Students are encouraged to make personal contact with individual faculty whose research program is of interest to them. Information describing each faculty member's program is available at our website (http://ncsu.edu/foodscience).

GRADUATE COURSES

FS(FSA) 520 Pre-harvest Food Safety
FS(FSA) 530 Post-harvest Food Safety
FS(FSA) 540 Food Safety and Public Health
FS 553 Food Laws and Regulations
FS(ANS,NTR) 554 Lactation, Milk, and Nutrition
FS(NTR) 555 Exercise Nutrition
FS 562 Postharvest Physiology
FS 567 Sensory Analysis of Foods
FS(FSA) 580 Professional Development and Ethics in Food Safety
FS 591 Special Problems in Food Science
FS 592 Special Research Problems in Food Science
FS 620 Special Problems
FS 623 Special Research Problems
FS 685 Master's Supervised Teaching
FS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
FS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
FS 690 Master's Examination
FS 693 Master's Supervised Research
FS 695 Master's Thesis Research
FS 696 Summer Thesis Research
FS 699 Master's Thesis Preparation
FS 705 Physical and Chemical Properties of Muscle Foods
FS(NTR) 706 Vitamin Metabolism
FS(NTR) 710 Food Lipids
FS 722 Microbial Food Safety
FS(MB) 725 Fermentation Microbiology
FS(NTR) 730 Human Nutrition
FS 741 Thermal Processing of Foods
FS 751 Food Ingredient Technology in Product Development
FS 753 Food Laws and Regulations
FS 765 Polymer and Colloidal Properties of Foods
FS 780 Seminar in Food Science
FS 785 Food Rheology
FS 791 Special Problems in Food Science
FS 792 Special Research Problems in Food Science
FS 820 Special Problems
FS 823 Special Research Problems
FS 885 Doctoral Supervised Teaching
FS 890 Doctoral Preliminary Examination
FS 893 Doctoral Supervised Research
FS 895 Doctoral Dissertation Research
FS 896 Summer Dissertation Research
FS 899 Doctoral Dissertation Preparation

Foreign Languages And Literatures

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
French Language and Literature				Y			
Spanish Language and Literature				Y			

GRADUATE FACULTY

Professors: G. A. Dawes, T. Feeny, R. V. Gross, J. R. Kelly, Y. B. Rollins, M. L. Sosower, M. A. Witt Frese; ***Professors Emeriti:*** G. F. Gonzalez; ***Associate Professors:*** V. Bilenkin, H. G. Braunbeck, J. S. Despain, M. D. Garval, H. Jaimes, M. M. Magill, D. M. Marchi, J. Mari, J. P. Mertz, L. A. Mykyta, M. L. Salstad, E. Tai, A. Taj; ***Associate Professors Emeriti:*** R. M. A. Alder, S. G. Alonso; ***Assistant Professors:*** M. A. Darhower, S. Garrigan, E. Vilches, T. Wolford

Admission Requirements:

- A baccalaureate degree from an accredited college or university
- Undergraduate GPA of 3.0 or above
- Narrative statement of professional and personal objectives (in English, 300 words).
- Language proficiency as determined by writing sample and a speaking sample in the target language (French or Spanish).
- Some applicants may be given provisional admittance on condition of taking specific undergraduate courses conducted in the target language and passing with a B or better.
- Students admitted provisionally must complete at least 9 hours of graduate courses making grades of A or B to be considered for full graduate standing.

Degree Requirements: Both programs require at least 30 hours of course work and a culminating project. Each student's program is tailored to enhance his or her career objectives. Students who plan to pursue a Ph.D. receive the requisite training and assistance. Students who plan to teach in community colleges or universities may complete the degree without a concentration or with a concentration in another language, English, History, or another discipline. K-12 teachers who already have "A" licensure may earn "M" licensure by taking 36 hours in specified disciplines.

Student Financial Support: Graduate assistantships and fellowships are available to students in both programs and are awarded by open competition.

Other Relevant Information: Students may be admitted for the fall or spring semesters but not summer sessions. Deadlines for applications for fall semester are February 15 for international students and May 1 for U.S. students. Deadlines for spring semester are May 1 for international students and November 1 for U.S. students.

GRADUATE COURSES

FL(ECI) 505 Issues and Trends in Foreign Language Education--Theory and Practice
FL(ECI) 506 Instructional Technology in Foreign Language Education
FL 507 College Teaching of Foreign Languages
FL(ENG) 541 Critical Approaches to Literature and Culture

FRENCH
FLF 502 Variety in Language: French
FLF 511 Approaches to French Translation

FLF 516 Art and Society in France
FLF 524 French Theater in Cultural Contexts
FLF 525 Literature, Cinema and Culture of the Francophone World
FLF 592 Seminar in French Studies
FLF 595 Special Topics in French
FLF 630 Independent Study in French
FLF 675 Special Project in French
FLF 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
FLF 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

SPANISH
FLS 500 Methods and Techniques in Spanish Translation
FLS 502 Linguistic Structure of Spanish
FLS 503 Spanish Applied Linguistics
FLS 504 Spanish Language Change and Variation
FLS 519 Children's Literature of Spain Since 1950
FLS 520 Spanish American Women Writers
FLS 525 Poetry and Politics in Latin America
FLS 592 Graduate Seminar in Hispanic Studies
FLS 595 Special Topics in Spanish
FLS 630 Independent Study in Spanish
FLS 675 Special Project in Spanish
FLS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
FLS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

Forestry

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Forestry	Y		Y		Y		

GRADUATE FACULTY

B. Goldfarb, ***Department Head***

Director of Graduate Programs:
S. T. Warren, Box 8008, 515.7996, sarah_warren@ncsu.edu, Forestry

Carl Alwin Schenck Professor: H. L. Allen
Distinguished University Professor: E. B. Cowling
Edwin F. Conger Professor and Distinquished University Professor: R. R. Sederoff

Professors: R. C. Abt, R. R. Braham, R. D. Brown, R. I. Bruck, V. L. Chiang, F. W. Cubbage, P. D. Doerr, L. J. Frampton Jr., E. C. Franklin, D. J. Frederick, B. Goldfarb, L. F. Grand, J. D. Gregory, E. Guthrie-Nichols, A. E. Hassan, J. B. Jett Jr., E. J. Jones, S. Khorram, R. A. Lancia, R. Lea, S. E. McKeand, L. A. Nielsen, J. P. Roise, J. D. Wellman, W. E. Winner; ***Research Professors:*** W. S. Dvorak, B. Li, S. Lu; ***Professors (USDA):*** F. E. Bridgwater Jr.; ***Professors (USDI/USFS):*** J. A. Collazo; ***Visiting Professors:*** J. Laarman; ***Adjunct Professors:*** B. Dimitriades, P. M. Dougherty, C. Greenberg, J. P. McTague, M. Olsson, K. H. Riitters; ***Professors Emeriti:*** A. W. Cooper, C. B. Davey, J. W. Duffield, D. L. Holley Jr., R. C. Kellison, J. R. McGraw, R. L. Noble, P. A. Sanchez, A. G. Wollum II, B. J. Zobel; ***Associate Professors:*** H. V. Amerson, R. E. Bardon, G. B. Blank, H. Cheshire, G. R. Hess, C. E. Moorman, D. J. Robison, T. H. Shear, E. O. Sills, T. A. Steelman, A. M. Stomp, R. J. Weir, R. W. Whetten; ***Research Associate Professors:*** G. R. Hodge; ***Associate Professors (USDA):*** S. G. McNulty; ***Adjunct Associate Professors:*** B. A. Bergmann, R. G. Campbell, W. G. Dorgeloh, T. R. Fox, J. Iiames, D. L. Loftis, G. Sun, R. H. Wynne; ***Assistant Professors:*** B. P. Bullock, C. S. DePerno, D. Hazel, A. James, J. S. King, M. A. Megalos, S. A. C. Nelson, M. N. Peterson; ***Research Assistant Professors:*** K. Beratan, H. I. Cakir, F. Isik, Y. T. Yamamoto; ***Visiting Assistant Professors:*** S. Moore, S. Pattanayak; ***Adjunct Assistant Professors:*** D. M. Amatya, J. Coulston, C. B. Davidson, B. Hannrup, L. A. Henderson, T. P. Holmes, J. F. Knight, C. Maier, D. E. Mercer, A. Myburg, J. U. Nilsson, J. Phelan, J. P. Prestemon, R. Rubilar, J. L. Schuler, L. Van Zyl, D. N. Wear

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: H. A. Devine, F. P. Hain, L. E. Hinesley, R. A. Powell; ***Professors (USDI/USFS):*** T. R. Simons; ***Professors Emeriti:*** P. T. Bromley; ***Named Professors Emeriti:*** S. W. Buol; ***Professors Emeriti:*** E. A. Wheeler; ***Associate Professors:*** L. D. Gustke; ***Adjunct Associate Professors:*** W. J. Fleming

The department offers training in all of the major sub-disciplines of forest, natural resources, and environmental-related science and management. Considerable flexibility is allowed in developing graduate programs tailored to the student's objectives.

Admission Requirements: All parts of the application, including the GRE general test, are considered in making decisions. Admission is competitive and depends on the willingness of at least one member of the faculty to serve as major professor. An undergraduate degree in forestry is not required.

Master's Degree Requirements: Course work requirements range from 30 to 36 credits depending on the specific master's option. Students without an appropriate background will require additional preparatory work.

Doctoral Degree Requirements:
As a rule, students must complete a master's degree before entering the Ph.D. program. However, exceptionally well-prepared students may petition to have their degree objective changed to Ph.D. before completing the master's degree. In addition to the dissertation, Ph.D. programs require 36 to 54 credits of course work beyond the master's degree.

Student Financial Support: Merit-based research assistantships are available every year in most fields of specialization. Stipend levels allow students to graduate without incurring significant debt. Those who begin without an assistantship are considered for funding as projects become available. Additional funding is available through a limited number of teaching assistantships.

Other Relevant Information: Every graduate student must meet two requirements: (1) register for a one-credit research methodology course, FOR 603 or 803, early in his/her program and (2) begin the final oral exam with a seminar to the department based on work accomplished during the graduate program. Ph.D. students must meet a one-time teaching requirement by assisting a faculty member teach an undergraduate forestry or natural resources course.

GRADUATE COURSES

FOR 501 Dendrology
FOR 502 Forest Measurements
FOR 503 Tree Physiology
FOR 505 Forest Management
FOR 506 Timber Investment Analysis
FOR 507 Silviculture Mini Course
FOR 509 Forest Resource Policy
FOR 510 Introduction to GPS
FOR 513 Silviculture for Intensively Managed Plantations
FOR 519 Forest Economics
FOR(NR) 520 Watershed and Wetlands Hydrology
FOR 522 Consulting Forestry
FOR 534 Forest Operations and Analysis
FOR(NR) 536 Introduction to Visual Basic for GIS
FOR 540 Advanced Dendrology
FOR 554 Principles of Spatial Analysis
FOR 561 Forest Communities of the Southeastern Coastal Plain
FOR 562 Forest Communities of the Southern Appalachians
FOR 583 Tropical Forestry
FOR(FW) 585 Advanced Wildlife Habitat Management
FOR 595 Special Topics
FOR 601 Graduate Seminar
FOR(FW) 602 Seminar in Wildlife Management
FOR 603 Seminar in Forest Research
FOR 608 Forest Management and Planning
FOR 610 Special Topics
FOR 615 Advanced Special Topics
FOR 680 Field Practicum in Tropical Forestry
FOR 685 Master's Supervised Teaching
FOR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
FOR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
FOR 690 Master's Examination
FOR 693 Master's Supervised Research
FOR 695 Master's Thesis Research
FOR 696 Summer Thesis Research
FOR 699 Master's Thesis Preparation
FOR 701 Advanced Hydrology
FOR 713 Advanced Topics in Silviculture
FOR(GN) 725 Forest Genetics
FOR(GN) 726 Advanced Topics in Quantitative Genetics
FOR 727 Tree Improvement Research Techniques

FOR 728 Quantitative Forest Genetics Methods
FOR 733 Forest Ecosystem Analysis
FOR 750 Ecological Restoration
FOR 753 Environmental Remote Sensing
FOR(ENT) 765 Advanced Forest Entomology
FOR 772 Forest and Renewable Policies on the Public Lands
FOR 773 Ecophysiology of Forest Production
FOR 774 Topics in Forest Modeling
FOR 784 The Practice of Environmental Impact Assessment
FOR 795 Special Topics
FOR 801 Seminar
FOR 803 Seminar in Forest Research
FOR 810 Special Topics
FOR 815 Advanced Special Topics
FOR 885 Doctoral Supervised Teaching
FOR 890 Doctoral Preliminary Examination
FOR 893 Doctoral Supervised Research
FOR 895 Doctoral Dissertation Research
FOR 896 Summer Dissertation Research
FOR 899 Doctoral Dissertation Preparation

Genetics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Genetics	Y		Y		Y		

GRADUATE FACULTY

S. E. Curtis, ***Department Head***
S. E. Curtis, Box 7614, 515.2292, securtis@ncsu.edu, Genetics

Distinguished University Professor and William Neal Reynold Professor Emeritus: C. S. Levings, III
Distinguished University Professor Emeritus: J. G. Scandalios
William Neal Reynolds Distinguished Professor: W. R. Atchley
William Neal Reynolds Professor: G. C. Gibson, M. D. Purugganan, Z. Zeng
William Neal Reynolds Professor and Distinguished University Professor: T. F. Mackay

Professors: S. E. Curtis, W. H. McKenzie, S. L. Spiker, J. L. Thorne; ***Adjunct Professors:*** M. Chilton; ***Professors Emeriti:*** W. D. Hanson, W. E. Kloos, D. F. Matzinger, H. E. Schaffer, C. W. Stuber, A. C. Triantaphyllou; ***Associate Professors:*** T. H. Emigh, J. W. Mahaffey, W. O. McMillan; ***Assistant Professors:*** J. M. Alonso, R. G. Franks, L. D. Mathies; ***Research Assistant Professors:*** P. A. Estes, D. M. Nielsen; ***Adjunct Assistant Professors:*** R. E. Cannon, M. A. Conkling, P. Hurban, S. Uknes

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: R. S. Boston, R. A. Dean, M. M. Goodman, F. L. Gould, L. K. Hanley-Bowdoin, T. R. Klaenhammer, R. R. Sederoff, W. F. Thompson, R. R. H. Anholt, S. A. Lommel, C. H. Opperman, D. Robertson; ***Named Professors Emeriti:*** E. J. Eisen; ***Assistant Professors:*** C. M. Grozinger

The department provides a well-balanced program of graduate course work and research training. The faculty conducts basic research in the genetics of a variety of model animal, plant, and microbial systems. The student has a choice of research projects in the broad areas of molecular, biochemical, developmental, quantitative and population genetics.

Admission Requirements: Applicants may come from a number of undergraduate programs that include biological, agricultural, physical and mathematical science training. All applications are screened by a departmental committee, and the best qualified applicants will be accepted up to the number of spaces that are available for new students.

Master's Degree Requirements: The M.S. degree requires a minimum of 30 credit hours; the Master's of Genetics requires a minimum of 36 credit hours. A 12-hour sequence of five core courses is required of all majors; nine of these hours are required for minors. A minimum of two additional graduate genetics courses is required.

Doctoral Degree Requirements: A 14-hour sequence of six core courses is required of all majors; nine of these hours are required for minors. A minimum of four additional graduate genetics courses is required.

Student Financial Support: Graduate assistantships and fellowships are available to the students from a number of sources. Information will be provided at the time of application.

Other Relevant Information: New students supported by fellowships or research assistantships will rotate

through three laboratories during their first semester. At the end of the semester, they will choose a laboratory for their research activities consistent with their interests and available research projects. Provisions are available for a co-major and cooperative research in more than one laboratory.

GRADUATE COURSES

GN 504 Human Genetics
GN 513 Advanced Genetics
GN 685 Master's Supervised Teaching
GN 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
GN 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
GN 690 Master's Examination
GN 693 Master's Supervised Research
GN 695 Master's Thesis Research
GN 696 Summer Thesis Research
GN 699 Master's Thesis Preparation
GN 701 Molecular Genetics
GN 702 Cellular and Developmental Genetics
GN 703 Population and Quantitative Genetics
GN(ANS) 708 Genetics of Animal Improvement
GN(ANS) 713 Quantitative Genetics and Breeding
GN(CS) 719 Origin and Evolution of Cultivated Plants
GN(CS,HS) 720 Molecular Biology in Plant Breeding
GN(ST) 721 Genetic Data Analysis
GN(FOR) 725 Forest Genetics
GN(FOR) 726 Advanced Topics in Quantitative Genetics
GN(PB,MB,PP) 730 Fungal Genetics and Physiology
GN(GS) 735 Functional Genomics
GN(ZO) 740 Evolutionary Genetics
GN(CS,HS) 745 Quantitative Genetics in Plant Breeding
GN(CS,HS) 746 Breeding Methods
GN(CS,HS,PP) 748 Breeding for Pest Resistance
GN 750 Developmental Genetics
GN 755 Population Genetics
GN(ST) 756 Computational Molecular Evolution
GN(BI,ST) 757 Statistics for Molecular Quantitative Genetics
GN(MB) 758 Prokaryotic Molecular Genetics
GN 760 Experimental Microbial Genetics
GN(BCH) 761 Advanced Molecular Biology of the Cell
GN(BCH) 768 Nucleic Acids: Structure and Function
GN(ST) 770 Statistical Concepts in Genetics
GN 793 Special Topics in Genetics
GN 801 Seminar
GN 809 Colloquium
GN 810 Special Topics in Genetics
GN 820 Special Problems
GN 850 Professionalism and Ethics
GN(CS,HS) 860 Plant Breeding Laboratory
GN(CS,HS) 861 Plant Breeding Laboratory
GN 885 Doctoral Supervised Teaching
GN 890 Doctoral Preliminary Examination
GN 893 Doctoral Supervised Research
GN 895 Doctoral Dissertation Research
GN 896 Summer Dissertation Research
GN 899 Doctoral Dissertation Preparation

Genomic Sciences

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Bioinformatics	Y				Y		
Functional Genomics	Y		Y		Y		

GRADUATE FACULTY

Directors of Graduate Programs:
D. M. Bird, Box 7566, 515.6813, david_bird@ncsu.edu, Functional Genomics
Z. Zeng, Box 7566, 515.1942, zeng@stat.ncsu.edu, Bioinformatics

Alcoa Professor of Chemical Engineering: R. M. Kelly
Distinguished University Professor: M. M. Goodman, W. F. Thompson
Distinguished University Research Professor: D. L. Bitzer
Edwin F. Conger Professor and Distinquished University Professor: R. R. Sederoff
Glaxo Distinguished University Professor: J. S. Lindsey
William Neal Reynolds Distinguished Professor: W. R. Atchley, W. F. Boss
William Neal Reynolds Professor: R. S. Boston, M. Davidian, R. A. Dean, G. C. Gibson, L. K. Hanley-Bowdoin, J. Odle, G. A. Payne, M. D. Purugganan, Z. Zeng
William Neal Reynolds Professor and Distinguished University Professor: T. F. Mackay
William Neal Reynolds Professor and University Distinguished Professor: T. R. Klaenhammer
William Neal Reynolds Professor Emeritus: E. J. Eisen

Professors: K. B. Adler, P. F. Agris, R. R. H. Anholt, D. M. Bird, E. B. Breitschwerdt, D. T. Brown, J. Cavanagh, V. L. Chiang, S. D. Clouse, S. E. Curtis, M. E. Daub, G. A. Dean, R. E. Dewey, C. E. Farin, L. J. Frampton Jr., F. J. Fuller, B. Goldfarb, C. L. Hemenway, J. M. Hughes-Oliver, E. L. Kaltofen, S. Leath, D. H. Ley, S. A. Lommel, E. S. Maxwell, S. E. McKeand, E. S. Miller, J. W. Moyer, D. C. Muddiman, C. H. Opperman, P. E. Orndorff, J. N. Petitte, R. M. Petters, J. Piedrahita, T. H. Regan, J. B. Ristaino, D. Robertson, B. Sherry, R. C. Smart, C. V. Sullivan, J. L. Thorne, W. A. F. Tompkins, A. A. Tsiatis, M. A. V. Vouk, B. M. Wiegmann, P. L. Wollenzien; ***Research Professors:*** B. Li; ***Professors (USDA):*** J. B. Holland; ***Adjunct Professors:*** J. C. Brocklebank, N. L. Kaplan, R. D. Wolfinger; ***Associate Professors:*** H. V. Amerson, P. Arasu, R. J. Borski, M. Breen, J. W. Brown, A. C. Clark, A. C. Clark, J. E. Gadsby, S. K. Ghosh, J. Godwin, A. M. Grunden, J. M. Haugh, J. M. Horowitz, S. Kathariou, J. W. Mahaffey, C. Mattos, P. E. Mozdziak, S. V. Muse, M. C. Sagui, R. W. Whetten, Q. Xiang, D. Zhang; ***Adjunct Associate Professors:*** E. R. Hauser, J. L. Stephenson Jr.; ***Assistant Professors:*** J. M. Alonso, C. M. Ashwell, M. S. Ashwell, J. Barnes, I. Carbone, J. P. Cassady, R. G. Franks, M. B. Goshe, C. M. Grozinger, B. J. Grubb, S. Heber, M. Koci, D. S. Lalush, H. Liu, J. L. Lubischer, L. D. Martin, L. D. Mathies, J. W. Olson, M. Rodriguez-Puebla, M. L. Sikes, E. A. Stone, J. Tzeng, J. Yoder; ***Research Assistant Professors:*** P. A. Estes, D. M. Nielsen; ***Visiting Assistant Professors:*** A. Y. Scales

ASSOCIATE MEMBERS OF THE PROGRAM

Associate Professors: A. C. Clark

Genomic sciences has two components. Functional genomics, the generation of large bodies of data relating to organism function, encompasses gene discovery, gene expression, protein and nucleic acid structure and function, gene and gene product interactions, and genomic approaches to breeding and comparative studies relevant to ecology and evolutionary biology. Bioinformatics is the analysis of these vast and complex data sets including methods to analyze extremely large sets of genomic information such as DNA sequences and

expression from DNA microarrays. Students register in either of these two fields but also receive a solid grounding in the other through core courses common to both programs. Unique and exceptional resources include the Bioinformatics Research Center and the Genome Research Laboratory.

Admission Requirements: Students should have an undergraduate major in the biological or physical sciences, mathematics, statistics or computer science and have completed calculus and other comparable courses. In addition to the other application requirements, a student should submit a statement of interests and career goals.

Master's Degree Requirements: Students take a 15-credit core curriculum of courses common to both programs followed by courses specific to the degree and discipline. The Master's of Bioinformatics requires a minimum of 33-36 credit hours. The Master's of Functional Genomics requires a minimum of 30 credit hours, and the Master's of Science in Functional Genomics requires a minimum of 36 credit hours.

Doctoral Degree Requirements: The Ph.D. program requires a total of 72 credits, and all students participate in a journal club, monthly seminar series and research ethics training. A co-mentoring system exists between bioinformatics and functional genomics through which each student has advisors from both disciplines. Throughout the program they will have the opportunity to gain practical experience in the Genome Research Laboratory, Bioinformations Research Center and DNA Sequencing Facility.

Student Financial Support: A significant number of fellowships are available through the genomics program, and students may also be supported by research grant funds awarded to genomics faculty members.

GRADUATE COURSES
Many courses are available and cross-listed through 25 participating departments in the Colleges of Agriculture & Life Sciences, Engineering, Natural Resources, Physical & Mathematical Sciences, and Veterinary Medicine.

NCSU Graduate Catalog

Global Innovation Management

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Global Innovation Management					Y		

GRADUATE FACULTY

Director of Graduate Programs:
D. H. Henard, Box 7229, 515.8945, dhhenard@ncsu.edu, Business Management

Professors: M. Montoya-Weiss, D. P. Pagach; ***Associate Professors:*** L. Aiman-Smith, D. L. Baumer, S. K. Markham, J. K. McCreery; ***Assistant Professors:*** E. A. Baker, J. Barnes, D. H. Henard, D. Sirdeshmukh, M. D. Walker

ASSOCIATE MEMBERS OF THE PROGRAM

Assistant Professors: S. Schanz

The Jenkins Graduate School of Management, part of the North Carolina State University College of Management, in partnership with the Université Paul Cézanne Graduate School of Management (IAE) in Aix-en-Provence France, offers a Master's degree in Global Innovation Management. The curriculum is designed to give engineering, science and other technology-oriented students a strong exposure to core business management skills while providing in-depth exposure to a host of global innovation management issues. It was designed specifically for students who are looking to create a personal competitive advantage for today's global job market.

Students in the program will come from around the world and classes will be held in both France and the United States. Students will be taught by international professors who are leaders in their fields. Interactions with global firms will occur both in the classroom and via internships.

Admission Requirements: Applicants are required to complete the standard NC State Graduate School application process. Applicant assessments will be done on an individual-by-individual basis. Concurrent acceptance activities will be at both IAE and NC State.

U.S. applicants will need a valid U.S. passport and visa for traveling to France. Upon acceptance to the program, students can apply for a visa. Applicants should also be prepared for additional program costs (airfare to and from Europe and travels within Europe, lodging and meals while in France).

Master's Degree Requirements: The MGIM degree requires 30 credit hours and can be completed in one year. It does not require courses in subject areas such as economics and operations management which are required in the MBA. This one-year program awards two master's degrees:(1) a degree from NC State University and (2) a degree from the Université Paul Cézanne.

Core Courses:
BUS 590 Special Topics in Business Management (Business Relationship Management)
BUS 590 Special Topics in Business Management (Technology & Innovation Management)
BUS 564 Project Management

Elective Courses:
BUS 579 Entrepreneurship
BUS 504 Technology, Competition, and the Law

BUS 590 Special Topics in Business Management (Services Innovation)

Other Relevant Information: After two years of full-time work experience, students who earn the dual master degree in Global Innovation Management can receive their full-time MBA from NC State University's Jenkins Graduate School of Management after completing just one additional year of study.

NCSU Graduate Catalog

Graphic Design

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Graphic Design					Y		

GRADUATE FACULTY

S. Piedrafita, ***Department Head***

Director of Graduate Programs:
M. J. Davis, Box 7701, 515.8335, meredith_davis@ncsu.edu, Graphic Design

Professors: M. J. Davis, M. Scotford; ***Professors Emeriti:*** A. S. Lowrey; ***Associate Professors:*** K. L. Bailey, D. G. Crisp, S. Piedrafita, S. Townsend; ***Assistant Professors:*** P. A. Brock, W. Temple

Recognizing that graphic design is both a social activity and a form of cultural production, faculty and students in the Department of Graphic Design define the study of the discipline as necessarily contextual; graduate research examines the creation, reproduction, distribution, and reception of design from a multidisciplinary perspective. The Master of Graphic Design Program also emphasizes the importance of understanding design as the creation of cognitive and cultural artifacts; study focuses on the construction of messages, the reproduction of such artifacts, the systems for their distribution, and their reception within various cultures of society.

Graduate students in graphic design learn through their own search for problems within critical content frameworks presented by the faculty. The program places primary importance on the ability of students to be critical agents; to seek problems and to pose questions. Faculty evaluate graduate students on their capacity to define individual investigations and to support their decision-making with an independent program of reading and research; on their ability to critically evaluate and articulate discoveries; and on their skills in synthesizing ideas through the creation of design artifacts.

The Master of Graphic Design Program provides focused study and research in the discipline that reflects concern for how designers will shape and respond to the changing technological and social communications environments of the future. The Program has the broad objective to educate socially responsible, intellectually curious, historically aware, and technologically adept communication design professionals.

In the Track III Program, students whose undergraduate preparation is in fields other than graphic design examine relationships between their previous study and graphic design. While acquiring design skills and knowledge in graphic design, they apply concepts and methods from their previous study to design research and innovation.

Admissions Requirements: Students must make application to the Department of Graphic Design by January 15. In addition to Graduate School requirements, the department requires department personal data forms, a slide portfolio of design and two-dimensional visual work, and a statement of intent. The GRE is required for students whose first degree is not in Graphic Design.

Master's Degree Requirements: The Master's of Graphic Design degree requires a minimum of 48 credit hours. Studio credits presented for transfer must be accompanied by a portfolio of work from the courses under consideration.

Student Financial Support: The department has limited provisions for tuition remission and assistantships. Assistantships are awarded on the basis of student and departmental needs. Assistantship applications are

available from the Department of Graphic Design and should be submitted with the application for admission (for incoming students) or by the advertised deadline (for continuing students).

GRADUATE COURSES

GD 501 Graduate Graphic Design Studio I
GD 502 Graduate Graphic Design Studio II
GD 503 Graduate Graphic Design Studio III
GD 510 Imaging for Graphic Design IV
GD 517 Advanced Typographic Systems
GD 571/DDN 771 Design as Cognitive Artifact
GD 572/DDN 772 Design as Cultural Artifact
GD 573/DDN 773 New Information Environments
GD 580 Special Topics in Graphic Design History
GD 581 Graphic Design Final Project Research
GD 588 Final Project Studio in Graphic Design
GD 592 Special Topics in Graphic Design
GD 610 Special Topics in Graphic Design
GD 630 Independent Study in Graphic Design
GD 676 Special Project in Graphic Design
GD 685 Master's Supervised Teaching
GD 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
GD 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
GD 690 Master's Examination

NCSU Graduate Catalog

History

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
History				Y			
Public History				Y			

GRADUATE FACULTY

J. K. Ocko, ***Department Head***

Director of Graduate Programs:
K. S. Vincent, Box 8108, 513.2233, steven_vincent@ncsu.edu, History

Professors: W. Adler, J. R. Banker, D. P. Gilmartin, O. J. Kalinga, A. J. LaVopa, K. P. Luria, J. K. Ocko, S. T. Parker, R. H. Sack, R. W. Slatta, E. D. Sylla, K. S. Vincent; ***Professors Emeriti:*** B. F. Beers, M. L. Brown Jr., C. H. Carlton, A. J. De Grand, M. S. Downs, R. W. Greenlaw, W. C. Harris, J. P. Hobbs, D. E. King, L. O. McMurry, G. W. O'Brien, J. Riddle, M. E. Wheeler, B. W. Wishy; ***Associate Professors:*** D. Ambaras, R. K. Bassett, H. Brewer, J. E. Crisp, W. A. Jackson III, A. F. Khater, M. G. Kim, W. C. Kimler, N. Mitchell, S. L. Spencer, G. D. Surh, K. P. Vickery, D. A. Zonderman; ***Adjunct Associate Professors:*** J. R. Lankford Jr.; ***Assistant Professors:*** M. Allen, M. M. Booker, K. M. Charron, D. DeTreville, C. T. Friend, B. M. Kelley, S. M. Lee, J. L. Mell, L. N. Minsky, T. Ort, H. C. Perros; ***Visiting Assistant Professors:*** J. C. Bonham; ***Adjunct Assistant Professors:*** J. W. Caddell

Admission Requirements: In the required career goals statement, the major country, topic and historical period of interest should be included. Students admitted provisionally must complete at least 9 hours of graduate courses making grades of A or B to be considered for full graduate standing.

Master's Degree Requirements: *Master of Arts Degree in History:* This program requires a total of 30 semester hours, including six hours for the thesis. Each student's program is tailored to enhance his or her career objectives. Social studies teachers, for example, may earn advanced competency on completion of the M.A. in history with additional course work in education. Similarly, students who plan to pursue a Ph.D. degree receive the requisite training and assistance. *Master of Arts Degree in Public History:* This non-thesis program requires 36 credit hours of course work. Half the hours fall in historical studies, the rest in applied history classes, including innovative courses in archival and special collections management, paper conservation, documentary editing, museum studies, and historic preservation. Students may select practicums in their own special areas of interest -- including archival management, historic site administration, museology, historic preservation, and historical publications.

Student Financial Support: Graduate assistantships and fellowships are available to students in both programs and are awarded by open competition.

Other Relevant Information: Application deadline is January 1; students are admitted for the fall semester only. The general portion of the GRE is required for those seeking admission to both the history and public history programs. No subject test is required for either program.

GRADUATE COURSES

HI 500 Civilizations of the Ancient Near East
HI 504 Rome to 337 A.D.
HI 505 History and Archaeology of the Roman Empire
HI 506 From Roman Empire to Middle Ages

HI 507 Islamic History to 1798
HI 509 The High Middle Ages
HI 510 Italian Renaissance
HI 511 The Protestant and Catholic Reformation of the 16th Century
HI 512 The Sexes and Society in Early Modern Europe
HI 514 France in the Old Regime
HI 515 The French Revolution
HI 518 Fascist Italy and Nazi Germany
HI 519 Modern European Imperialism
HI 520 European Diplomatic History
HI 521 European Intellectual History: The Eighteenth Century
HI 522 European Intellectual History: The 19th Century
HI 523 Women in European Enlightenment
HI 525 Tudor and Stuart England
HI 529 20th Century Britain
HI 530 Modern France
HI 531 Germany: Luther to Bismarck 1500-1871
HI 532 History of Germany Since 1871
HI 533 Theory and Practice of Oral History
HI 538 The Russian Empire to 1917
HI 539 History of the Soviet Union and After
HI 540 American Environmental History
HI 541 Colonial and Revolutionary U.S.
HI 542 Creating the Constitution: Origins and Development
HI 543 U.S. Constitutional History to 1883
HI 544 U.S. Constitutional History since 1870
HI 545 Early American Frontiers
HI 546 Civil War and Reconstruction
HI(WGS) 547 History of American Women to 1900
HI(WGS) 548 American Women in the Twentieth Century
HI 549 U.S. Labor to 1900
HI 550 U.S. Labor Since 1900
HI 551 The Vietnam War
HI 552 Recent America
HI 553 U.S.-Latin American Relations Since 1823
HI 554 History of U.S. Foreign Relations, 1900-Present
HI 555 History of the Civil Rights Movement
HI 556 Early American Thought
HI 557 Twentieth-century U. S. Intellectual History
HI 558 Modern American Historical Biography
HI 559 The Early American Republic
HI 560 American Religion after Darwin
HI 561 Civilization of the Old South
HI 562 Social History of the New South
HI 563 History and Memory
HI 564 Topics in the History of North Carolina
HI 569 Latin American Revolutions in the Twentieth Century
HI 571 Revolutionary China
HI 572 The Rise of Modern Japan, 1850-Present
HI 573 Japan's Empire in Asia, 1868-1945
HI 575 History of the Republic of South Africa
HI 576 Leadership in Modern Africa
HI 578 Islam and Christianity in Sub-Saharan Africa since the 19th Century
HI 579 Africa (Sub-Saharan) in the Twentieth Century
HI 580 Scientific Revolution: 1300-1700
HI 581 History of Life Sciences
HI 582 Darwinism in Science and Society
HI 583 Science and Religion in European History
HI 584 Science in European Culture
HI 585 History of American Technology
HI 586 History and Principles of the Administration of Archives and Manuscripts
HI 587 Application of Principles of Administration of Archives and Manuscripts
HI 588 Conservation of Archival and Library Materials
HI 589 Automation and Public History
HI 590 Documentary Editing and Historical Publication

HI 591 Introduction to Museology
HI 592 Advanced Museology
HI 593 Material Culture
HI 596 Introduction to Public History
HI 597 Historiography and Historical Method
HI 598 Historical Writing
HI 599 Independent Study
HI 642 Practicum in Public History
HI 685 Master's Supervised Teaching
HI 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
HI 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
HI 690 Master's Examination
HI 693 Master's Supervised Research
HI 695 Master's Thesis Research
HI 696 Summer Thesis Research
HI 699 Master's Thesis Preparation

Horticultural Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Horticultural Science	Y		Y		Y		

GRADUATE FACULTY

J. L. Kornegay, ***Department Head***

Director of Graduate Programs:
J. M. Dole, Box 7609, 515.3537, john_dole@ncsu.edu, Horticultural Science

Graduate Alumni Distinguished Professor Emeritus: D. M. Pharr

Professors: J. R. Ballington Jr., T. E. Bilderback, S. M. Blankenship, F. A. Blazich, S. D. Clouse, N. G. Creamer, J. M. Dole, P. R. Fantz, W. C. Fonteno II, R. G. Gardner, L. E. Hinesley, W. E. Hooker, J. L. Kornegay, D. W. Monks, J. C. Neal, M. M. Peet, E. B. Poling, T. G. Ranney, J. R. Schultheis, S. E. Spayd, T. C. Wehner, D. J. Werner, B. E. Whipker, L. G. Wilson, E. Young; ***Adjunct Professors:*** P. S. Zorner; ***Professors Emeriti:*** W. E. Ballinger, A. A. De Hertogh, W. R. Henderson, T. R. Konsler, C. M. Mainland, T. J. Monaco, P. V. Nelson, M. A. Powell Jr., W. A. Skroch, C. R. Unrath; ***Associate Professors:*** W. G. Buhler, J. D. Burton, J. M. Davis, G. E. Fernandez, S. J. McArtney, M. L. Parker, B. R. Sosinski, J. D. Williamson, G. C. Yencho; ***Assistant Professors:*** L. K. Bradley, B. A. Fair, C. C. Gunter, A. V. LeBude, P. A. Lindsey, A. M. Spafford; ***Research Assistant Professors:*** G. C. Allen II, K. M. Jennings; ***Adjunct Assistant Professors:*** F. C. Wise

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: M. D. Boyette, G. D. Hoyt, F. H. Yelverton

The NCSU Horticultural Science Graduate Program offers one of the most comprehensive programs in the country – providing students with a broad selection of courses and projects ranging from applied industry-oriented studies to molecular biology. Studies may focus on such commodity areas as floriculture, ornamental and landscape horticulture, pomology (fruit crops) and olericulture (vegetables) or on cross-commodity topics such as plant physiology, breeding and genetics, herbicide physiology and weed control, nutrition, propagation, tissue culture, growth regulators, postharvest physiology, environmental control, landscape horticulture and biochemistry.

Admission Requirements: To be admitted, a student should have completed course work in physics, mathematics, chemistry, biochemistry, soils, plant pathology, genetics, plant physiology, entomology and several courses in horticulture. An applicant deficient in course work may be admitted on a provisional basis until the deficiency is made up. Applicants must provide the basic graduate record examination (GRE) scores, three letters of reference, two official transcripts for each prior degree, and a statement of career goals.

Master's Degree Requirements: The Master's degree is a research-oriented degree requiring 30 credit hours and a written thesis. Four credits of core courses (HS 701-707 or 717), one credit of HS 601 must be completed. Up to 6 of the 30 credits may be research credits (HS 695), but there is no requirement to enroll for research credit. At least 20 semester hours must be 500, 600 or 700 level courses, and 6 of these credits must be at the 700 level.

For students wishing a more general educational background in horticultural science without the thesis requirement, the *Master of Horticultural Science* (M.H.S.) degree is offered. The M.H.S. requires 36 credit

hours. Twenty credits must be at the 500-700 level. One credit of HS 601 and at least four and no more than six credits of HS 693 are required. Up to 16 hours of 400-level courses can be taken as a part of the M.H.S. program, however, you may only take six hours of HS 400-level courses. Students are encouraged, but not required, to fulfill the four credit Horticultural Science core course requirement (HS 701-707 or 717).

Doctoral Degree Requirements: The Ph.D. program is designed for individuals desiring to pursue careers in research and teaching. A minimum of 54 credit hours beyond the Master of Science program is required. Three credits of the core courses (HS 701-707 or 717) and one credit of HS 601 are required; HS 601 is not required if already taken during the MS.

Student Financial Support: The department has a a limited number of assistantships available on a competitive basis for promising students. Benefits include tuition and health insurance as covered under the Graduate School's Graduate Student Support Plan. Applicants are considered for assistantship support at time of application. Those interested should apply at least nine months prior to their anticipated enrollment date. Also, many faculty programs have research grant-funded assistantships; potential students should contact faculty directly whose programs are of interest.

Other Relevant Information: Facilities for graduate studies include 40,500 square feet of greenhouse space at the USTL and the nearby Horticultural Field Lab; the University Phytotron (available for controlled environmental studies on horticultural crops); 19 well-equipped laboratories; 14 controlled temperature storage rooms, an extensive collection of plant materials, both living and preserved; and a variety of climates and soils from coast to mountains in North Carolina on fifteen outlying research stations. North Carolina has a dynamic horticulture industry, ranking among the top ten in many of the commodity areas.

GRADUATE COURSES

HS(PP,CS) 502 Plant Disease: Methods and Diagnosis
HS 525 Advanced Plant Propagation
HS(CS) 541 Plant Breeding Methods
HS 542 Advanced Vegetable Crop Management
HS 562 Postharvest Physiology
HS 590 Special Problems in Horticultural Science
HS 601 Seminar Techniques and Technology
HS 610 Special Topics
HS 615 Advanced Special Topics
HS 685 Master's Supervised Teaching
HS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
HS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
HS 690 Master's Examination
HS 691 Research Principles
HS 693 Master's Supervised Research
HS 695 Master's Thesis Research
HS 696 Summer Thesis Research
HS 699 Master's Thesis Preparation
HS 701 Carbohydrate Metabolism and Transport
HS 702 Biology of Plant Hormones
HS 703 Breeding Asexually Propagated Crops
HS 704 Plant Nomenclature
HS 705 Physiology of Flowering
HS 706 Fruit Development and Postharvest Physiology
HS 707 Environmental Stress Physiology
HS(CS) 715 Weed Science Research Techniques
HS(CS) 716 Weed Biology
HS(CS) 717 Weed Management Systems
HS(CS) 718 Biological Control of Weeds
HS(CS,GN) 720 Molecular Biology in Plant Breeding
HS 722 Mineral Nutrition in Plants
HS(CS,SSC) 725 Herbicide Chemistry
HS(CS,SSC) 727 Herbicide Behavior in Soil and Water

HS(CS) 729 Herbicide Behavior in Plants
HS 732 Vegetable Crop Physiology
HS(CS,GN) 745 Quantitative Genetics in Plant Breeding
HS(CS,GN) 746 Breeding Methods
HS(CS,GN,PP) 748 Breeding for Pest Resistance
HS 790 Special Problems in Horticultural Science
HS 815 Advanced Topics
HS(CS,GN) 860 Plant Breeding Laboratory
HS(CS,GN) 861 Plant Breeding Laboratory
HS 885 Doctoral Supervised Teaching
HS 890 Doctoral Preliminary Examination
HS 891 Research Principles
HS 893 Doctoral Supervised Research
HS 895 Doctoral Dissertation Research
HS 896 Summer Dissertation Research
HS 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Human Development & Family Studies

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Human Development & Family Studies-Family Life & Parent Educ			Y				

GRADUATE FACULTY

R. M. Stewart, ***Department Head***

Director of Graduate Programs:
K. B. DeBord, Box 7605, 515.9147, karen_debord@ncsu.edu, Family and Consumer Sciences

Professors: K. B. DeBord, P. C. Dunn, J. W. McClelland; ***Associate Professors:*** L. B. Bearon, S. D. Kirby, D. W. Matthews; ***Assistant Professors:*** A. Behnke, S. S. Jakes

Parent Education and Family Life Education are rapidly growing fields of research and practice. Demand for professionals to teach and create support systems for families is arising through government initiatives, community agencies, court systems, prisons, social service organizations, health care, schools, and communities. The Department of Family and Consumer Sciences at North Carolina State University and the Department of Human Development and Family Studies at the University of North Carolina at Greensboro offer a jointly administered Masters of Science degree in Human Development & Family Studies with a concentration in Family Life & Parent Education.

Admission Requirements: Students may apply to the joint program through either institution via the normal admissions procedures. A joint admissions committee will evaluate all applicants and be responsible for assigning the home institution.

Master's Degree Requirements: The M.S. in Human Development and Family Studies is a non-thesis degree that requires a total of 34 credit hours that includes six hours of core content, nine hours in the area of specialization, six hours of applied research, and four to seven hours of applied research internship and professional development. In addition, the student and program advisor will jointly select six to nine hours of elective courses.

Other Relevant Information: This program is designed to make most of the coursework accessible to students enrolled at either the University of North Carolina at Greensboro or North Carolina State University. Course delivery methods include: Web-based classes, seminar classes with a live internet feed connecting classrooms at both institutions, and on-campus seminars at both institutions. This is not a 100% online degree, however. A blending of teaching methods are used.

GRADUATE COURSES

FCS 500 Supervised Professional Experience in Family Life Education
FCS 510 Program Development and Evaluation in Family Life Education
FCS 512 Family and Community Partnerships
FCS 522 Family Life Education
FCS 523 Family Relationships Over the Life Course
FCS 524 Applications of Gerontology in Family Life Education
FCS 531 Effective Management of Family Resources
FCS 540 Environmental Influences on the Family
FCS 590 Special Topics in Family Life & Parenting Education
FCS 595 Contemporary Issues in Family Life Education
FCS 601 Independent Study in Family Life Education

NCSU Graduate Catalog

Immunology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Immunology	Y		Y				

GRADUATE FACULTY

Director of Graduate Programs:
S. L. Tonkonogy, Box 8401, 513.6252, sue_tonkonogy@ncsu.edu, Immunology

Professors: G. W. Almond, E. B. Breitschwerdt, G. A. Dean, F. J. Fuller, B. Hammerberg, S. M. Laster, T. Olivry, B. Sherry, M. B. Tompkins, W. A. F. Tompkins; ***Research Professors:*** E. A. Havell, S. Kennedy-Stoskopf; ***Adjunct Professors:*** M. J. Selgrade; ***Associate Professors:*** P. Arasu, L. C. Hudson, S. L. Jones, M. B. McCaw, S. L. Tonkonogy; ***Assistant Professors:*** A. Birkenheuer, M. Koci, L. D. Martin, M. L. Sikes, S. E. Suter, J. Yoder; ***Research Assistant Professors:*** K. E. Howard, S. K. Nordone; ***Adjunct Assistant Professors:*** M. I. Gilmour

Course offerings or research facilities are available in the following areas: infectious disease immunology, mucosal immunology, immunotoxicology, immunoparasitology, environmental immunology, and immunology of non-vertebrate species.

Students will be accepted into the immunology program based on their academic records (GPA) as undergraduates and/or as veterinary or medical students, results of the GRE, letters of recommendation and expression of interest in immunology. For the Ph.D. program, special consideration will be given to students who have had research experience (either an M.S. degree or other laboratory experience), especially in immunology, microbiology, biochemistry or genetics, or students who are completing strong clinical residency programs. Completed applications should be received by December 1 for fall admission.

To be admitted, a student should be a graduate of a major accredited biological science or medical science program. Students lacking appropriate courses may be considered for admission but will be required to make up certain undergraduate deficiencies without graduate credit.

Ph.D. and Master's students must take IMM 751 and at least one other 700-level immunology course, and a graduate-level biochemistry course (e.g. BCH 553 Biochemistry of Gene Expression). Also required are CBS 662 (Professional Conduct in Biomedical Research) and ST 511 (Experimental Statistics for Biological Sciences I). IMM 816 (Advanced Topics in Immunology) is required each semester. The remaining credit hours should include seminar (IMM 807) and research and teaching credits.

Students wishing to pursue a minor in Biotechnology should complete the core course in biotechnology (BIT 510) and two additional credit hours in the biotechnology series.

Graduate assistantships are available to students in the immunology program through the affiliated departments and graduate training grants. In addition, there are graduate research assistantships provided by individual faculty of the program.

The immunology program is an interdepartmental graduate program with faculty drawn from the College of Veterinary Medicine and the College of Agriculture and Life Sciences. For administrative purposes, all students accepted into the program will also have to be student members of one of the participating departments.

GRADUATE COURSES

IMM 685 Master's Supervised Teaching
IMM 690 Master's Examination
IMM 693 Master's Supervised Research
IMM 695 Master's Thesis Research
IMM 696 Summer Thesis Research
IMM 699 Master's Thesis Preparation
IMM(TOX) 705 Immunotoxicology
IMM(MB) 751 Immunology
IMM(CBS) 755 Immunoparasitology
IMM(CBS,PHY) 756 Immunogenetics
IMM(PO) 757 Avian Immunology
IMM(CBS,MB) 783 Advanced Immunology
IMM(CBS) 807 Seminar in Veterinary Microbiology/ Immunology
IMM 816 Advanced Topics in Immunology
IMM 885 Doctoral Supervised Teaching
IMM 890 Doctoral Preliminary Examination
IMM 893 Doctoral Supervised Research
IMM 895 Doctoral Dissertation Research
IMM 896 Summer Dissertation Research
IMM 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Industrial Design

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Industrial Design					Y		

GRADUATE FACULTY

B. W. Laffitte, ***Department Head***

Director of Graduate Programs:
P. R. Hooper, Box 7701, 515.8324, percy_hooper@ncsu.edu, Industrial Design

Professors: S. D. Brandeis, V. M. Foote, C. E. Joyner, H. Khachatoorian, G. E. Lewis, M. Pause; ***Associate Professors:*** C. D. Cox, L. M. Diaz, P. FitzGerald, P. R. Hooper, B. W. Laffitte, V. K. Plume, D. G. Raymond, S. M. Toplikar; ***Assistant Professors:*** T. Buie, B. Jin, S. Joines; ***Visiting Assistant Professors:*** E. C. Jordan

Industrial Design is the professional service of creating and developing concepts and specifications that optimize the value, function and appearance of products and product systems to the mutual benefit of both user and manufacturer. This service is often provided in the context of a cooperative working relationship with other members of a development group.

Typical groups include management, marketing, engineering and manufacturing specialists. Industrial designers place special emphasis on human characteristics, needs and interests. These require particular understanding of visual, tactile, safety and convenience criteria. Industrial designers combine these considerations with practical concern for technical processes and requirements for manufacture; marketing opportunities and economic constraints; and distribution, sales and servicing arrangements. Industrial designers are guided by the awareness of their obligations to protect and promote public safety and well being; to respect the environment; and to observe ethical business practices.

Graduates with a Master of Industrial Design have career opportunities in four general areas; corporate design offices in manufacturing companies, independent design consulting firms, governmental agencies and educational institutions.

Admissions Requirements: Applicants will be considered for admission on an individual basis and plans of study will be developed to take into account previous academic and professional experiences. In addition to other forms, applications must include departmental personal data forms and a portfolio.

Master's Requirements: The Master of Industrial Design degree requires a minimum of

- 30 credit hours for applicants with extensive experience in industry;
- 48 credit hours for applications with a Bachelor's degree in Industrial Design, or
- 78 credit hours for applications with Bachelor's degrees in an area other than Industrial Design.

GRADUATE COURSES

ID 500 Advanced Industrial Design (Series)
ID 511 Industrial Design Materials and Processes I
ID 512 Industrial Design Materials and Processes II
ID 532 Advanced Concepts in Product Engineering
ID 570 Advanced Industrial Design - Textiles (Series)
ID 581 Industrial Design Project Preparation

ID 582 Special Topics in Industrial Design
ID 588 Final Project Studio in Industrial Design
ID 602 Special Seminar
ID 630 Independent Study
ID 676 Special Project
ID 685 Master's Supervised Teaching
ID 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ID 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ID 690 Master's Examination

NCSU Graduate Catalog

Industrial Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Industrial Engineering	Y		Y		Y		

GRADUATE FACULTY

J. R. Wilson, ***Department Head***

Director of Graduate Programs:
R. E. King, Box 7906, 515.5186, king@ncsu.edu, Industrial Engineering

Clipton A. Anderson Distinguished Professor: R. Uzsoy
Henry A. Foscue Professor of Industrial Engineering and Furniture Manufacturing: C. T. Culbreth, Jr.
James T. Ryan Prof of Industrial Engineering: T. J. Hodgson
University Professor: S. E. Elmaghraby
Walter Clark Chair Professor of IE and Director of Graduate Programs IE: S. Fang

Professors: M. A. Ayoub, R. H. Bernhard, P. H. Cohen, Y. Fathi, R. E. King, Y. Lee, W. L. Meier Jr., S. D. Roberts, J. R. Wilson, R. E. Young; ***Adjunct Professors:*** X. Chao, G. Mirka; ***Professors Emeriti:*** J. R. Canada, H. L. Nuttle, R. G. Pearson, A. L. Prak, W. A. Smith Jr.; ***Associate Professors:*** D. R. Cormier, S. M. Hsiang, S. D. Jackson, D. B. Kaber, M. G. Kay, J. P. Lavelle, E. T. Sanii; ***Visiting Associate Professors:*** E. McDaniel; ***Adjunct Associate Professors:*** N. J. Currie, C. M. Sommerich, R. Stoll; ***Assistant Professors:*** O. Harrysson, J. S. Ivy; ***Research Assistant Professors:*** H. A. West II; ***Adjunct Assistant Professors:*** N. Couch, L. B. Davis, D. G. Humphrey, H. Lipscomb, S. D. Moon

ASSOCIATE MEMBERS OF THE PROGRAM

Professors Emeriti: T. Johnson; ***Associate Professors:*** T. L. Honeycutt

The graduate faculty in industrial engineering supports academic and research interests in four areas: manufacturing systems (manufacturing processes, CAM, CIM, robotics, automation, rapid prototyping and concurrent engineering); production systems (logistics, supply chain management, scheduling, inventory control, materials handling, facility design, furniture manufacturing and management, quality control, and engineering economics); systems analysis and optimization (stochastic processes, simulation, mathematical programming, and soft computing); and ergonomics (human performance, occupational safety, and biomechanics). The department faculty actively supports independent graduate degree programs in operations research, integrated manufacturing systems engineering, and financial mathematics.

Admission Requirements: Applications are accepted from undergraduate majors in engineering and in the behavioral, physical and mathematical sciences who meet prerequisites in calculus and linear algebra, computer science, and statistics.

Master's Degree Requirements: The M.S. degree requires 30 credit hours and involves depth of study in a specified area of concentration, nine hours in a minor, and six hours of research credit. The Master of Industrial Engineering (M.IE.) degree may be obtained by course work only; project work is optional. A minimum of 33 credit hours is required for the M.IE.

Doctoral Degree Requirements: This degree requires 72 credit hours of course and research work beyond the Bachelor's degree. Undergraduate students with superior credentials may apply directly to the doctoral program

and bypass the master's degree. For students who have completed the Master's degree, typically 30 to 36 hours of additional course work are required. A departmental written qualifying examination in two areas is required.

Student Financial Support: Research and teaching assistantships are available on a competitive basis to early applicants. Fellowships that supplement assistantship stipends are available to U.S. applicants with superior credentials. Award priority is given to Ph.D. and then to M.S. applicants.

GRADUATE COURSES

IE(MA,OR) 505 Linear Programming
IE 510 Applied Engineering Economy
IE 514 Manufacturing Product Engineering
IE 518 Manufacturing Operations Management
IE 530 Advanced Furniture Manufacturing System Design
IE 531 Advanced Furniture Facilities Design
IE(PSY) 540 Human Factors in Systems Design
IE 541 Occupational Safety Engineering
IE 543 Musculoskeletal Mechanics
IE 544 Occupational Biomechanics
IE(CSC) 546 Management Decision and Control Systems
IE(CSC) 556 Voice Input/Output Communication Systems
IE 589 Special Topics in Industrial Engineering
IE 601 Seminar
IE 610 Special Topics in Industrial Engineering
IE 637 Directed Study in Industrial Engineering
IE 639 Advanced Directed Study in Industrial Engineering
IE 646 Research Practicum in Occupational Biomechanics
IE 677 Industrial Engineering Projects
IE 685 Master's Supervised Teaching
IE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
IE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
IE 690 Master's Examination
IE 693 Master's Supervised Research
IE 695 Master's Thesis Research
IE 696 Summer Thesis Research
IE 699 Master's Thesis Preparation
IE 706 Design of Flexible Manufacturing Systems
IE 707 Real-time Control of Automated Manufacturing
IE(OR,MA) 708 Integer Programming
IE(OR) 709 Dynamic Programming
IE 711 Capital Investment Economic Analysis
IE 712 Bayesian Decision Analysis for Engineers and Managers
IE 715 Manufacturing Process Engineering
IE 716 Automated Systems Engineering
IE 717 Computerized Process Planning
IE 719 CIM System Design
IE 721 Advanced Problems in Management Systems Engineering
IE 723 Production Planning, Scheduling and Inventory Control
IE 725 Organizational Planning and Control
IE(OR) 726 Theory of Activity Networks
IE 731 Multi-attribute Decision Analysis
IE 736 Computer Integration of Manufacturing Systems
IE(PSY) 740 Engineering Psychology of Human-Computer Interaction
IE 741 Systems Safety Engineering
IE 742 Environmental Stress, Physiology and Performance
IE(PSY) 743 Ergonomic Performance Assessment
IE(PSY) 744 Human Information Processing
IE(PSY) 745 Human Performance Modeling
IE 748 Quality Engineering
IE 749 Tolerances in Design and Manufacturing
IE 750 Concurrent Engineering
IE 751 Modeling Imprecision in Design and Manufacturing
IE 753 Material Handling Systems

IE 754 Logistics Engineering
IE 755 The Just-in-time Production System
IE(CSC,ECE) 756 Advances in Voice Input/Output Communications Systems
IE 759 Constraint Modeling of Manufacturing Systems
IE 760 Applied Stochastic Models in Industrial Engineering
IE(OR) 761 Queues and Stochastic Service Systems
IE(CSC,OR) 762 Computer Simulation Techniques
IE(MA,OR) 766 Network Flows
IE 767 Upper Extremity Biomechanics
IE 768 Spine Biomechanics
IE(OR) 772 Stochastic Simulation Design and Analysis
IE 789 Advanced Special Topics in Industrial Engineering
IE 790 Advanced Special Topics in Systems Analysis and Optimization
IE 791 Advanced Special Topics in Manufacturing
IE 793 Advanced Special Topics in Production
IE 794 Advanced Problems in Ergonomics
IE 796 Research Practicum in Occupational Biomechanics
IE 801 Seminar
IE(PSY) 802 Area Seminar in Ergonomics
IE 803 Seminar in Product Safety and Liability
IE 804 Seminar in Applied Ergonomics
IE(MA,OR) 812 Special Topics in Mathematical Programming
IE 815 Advanced Special Topics in Industrial Engineering
IE 816 Advanced Special Topics in Systems Analysis and Optimization
IE 817 Advanced Special Topics in Manufacturing
IE 818 Advanced Special Topics in Production
IE 837 Directed Study in Industrial Engineering
IE 839 Advanced Directed Study in Industrial Engineering
IE 861 Production Systems
IE(OR) 862 Scheduling and Routing
IE 877 Industrial Engineering Projects
IE 885 Doctoral Supervised Teaching
IE 890 Doctoral Preliminary Examination
IE 893 Doctoral Supervised Research
IE 895 Doctoral Dissertation Research
IE 896 Summer Dissertation Research
IE 899 Doctoral Dissertation Preparation

Integrated Manufacturing Systems Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Integrated Manufacturing Systems Engineering					Y		

GRADUATE FACULTY

Director of Graduate Programs:
S. D. Jackson, Box 7915, 515.3808, steve_jackson@imsei.ncsu.edu, Integ. Mfg. Sys. Engineering

Alan T. Dickson Distinguished University Professor: M. A. Rappa
Bank of America University Distinguished Professor: R. B. Handfield
Burlington Industries Professor of Textile Technology: R. L. Barker
Henry A. Foscue Professor of Industrial Engineering and Furniture Manufacturing: C. T. Culbreth, Jr.
James T. Ryan Prof of Industrial Engineering: T. J. Hodgson

Professors: M. D. Boyette, Y. A. Chen, T. G. Clapp, M. Devetsikiotis, Y. Fathi, T. K. Ghosh, W. J. Jasper, R. E. King, J. W. Leach, Y. Lee, T. J. Little, W. L. Meier Jr., M. Montoya-Weiss, W. J. Rasdorf, P. I. H. Ro, S. D. Roberts, R. D. Rodman, J. P. Rust, A. M. Seyam, J. R. Wilson, R. E. Young; ***Research Professors:*** R. L. Lemaster; ***Professors Emeriti:*** R. E. Carawan, P. L. Grady, T. Johnson, H. L. Nuttle, W. A. Smith Jr., C. F. Zorowski; ***Associate Professors:*** D. R. Bahler, P. Banks-Lee, K. T. Barletta, G. D. Buckner, S. N. Chapman, D. R. Cormier, G. L. Hodge, S. D. Jackson, M. G. Kay, K. Mitchell, M. K. Ramasubramanian, E. T. Sanii; ***Adjunct Associate Professors:*** C. M. Sommerich, J. Taheri; ***Assistant Professors:*** O. Harrysson, J. S. Ivy, E. Sumner, D. Warsing; ***Adjunct Assistant Professors:*** J. A. Janet, J. C. Sutton III

The Integrated Manufacturing Systems Engineering (IMSE) Institute was established in 1984. IMSE provides multidisciplinary graduate-level education and practical training opportunities in the theory and practice of integrated manufacturing systems engineering at the masters level. IMSE focuses on providing a manufacturing presence and a program environment in the College of Engineering where faculty, graduate students and industry can engage cooperatively in multidisciplinary graduate education, basic and applied research, and technology transfer in areas of common interest related to modern manufacturing systems technology. The objective of the IMSE program is to offer students with traditional discipline backgrounds in engineering and the physical sciences an opportunity to broaden their understanding of the multidisciplinary area of manufacturing systems. Core areas of concentration are offered in manufacturing systems, logistics, mechatronics, and biomanufacturing.

Admission Requirements: Admission to the IMSE master's program requires a B.S. degree from an accredited institution in engineering, physics, mathematics, or computer science. Check with the Institute if your degree is in a field other than these listed.

Master's Degree Requirements: The IMSE program requires a minimum of 27 hours of graduate course work and six hours of research project. The graduate course work includes five required core courses that provide a multidisciplinary overview of subject materials basic to manufacturing systems, logistics, mechatronics, and biomanufacturing. Specialization is provided in the student's elective courses. The six hours of research project is performed either individually or in teams in areas that compliment and reinforce the graduate course work.

Student Financial Support: Assistantships, fellowships and internships are available to qualified students. The full financial support package covers tuition and health insurance.

Fellowship/Internship: The IMSE internship program was established to provide a cooperative industrial and

academic experience for some IMSE students and our industrial sponsors. Several Fellowship/Internships awards are made available every year for special training in IMSE member companies. Students who are selected to participate in the internship program receive financial support for four semesters and one summer. Typically, the student attends classes for two semesters (fall and spring), works at the sponsor company for the following summer and fall semester, and completes the IMSE course requirements the following spring semester. The student uses the experience at the sponsor company as the basis for their IMSE research project.

Other Relevant Information: The Institute is supported by an industrial affiliates group of member companies. They have included ABB, Applied Materials, AT&T, AIMS, Bayer, B/S/H, Bosch Tools, CP&L, Caterpillar, Corning Cable Systems, CSX, Inc., Dupont, Elkay, Ford Motor, GE, IBM, Intel, John Deere Turf Care, Longistics, Magneti Marelli, Morganite, Nekton Technologies, and Nortel. The Institute interacts with member companies through an Industry Advisory Board and internships.

Core areas of concentration are offered in manufacturing systems, logistics, mechatronics, and biomanufacturing.

I. Manufacturing Core (one from each area)

Area 1	CSC(ECE) 510 - Software Engineering CSC 742 - Database Management Systems IE(CSC) 762 - Computer Simulation Techniques IE(CSC) 441 - Introduction to Simulation IE 719 - CIM System Design
Area 2	BUS 520 - Managerial Finance IE 510 - Applied Engineering Economy IE 711 - Capital Investment Economic Analysis
Area 3	IE 716 - Automated Systems Engineering IE 514 - Manufacturing Product Engineering IE 715 - Manufacturing Process Engineering
Area 4	IE 723 - Production Planning, Scheduling and Inventory Control
Area 5	MAE(WPS) 534 - Mechatronic Design MAE 742 - Design for Mechanical Assembly

II. Logistics Core (one from each area)

Area 1	CSC(ECE) 510 - Software Engineering CSC 742 - Database Management IE(CSC) 762 - Computer Simulation Techniques IE(CSC) 441 - Introduction to Simulation IE 719 - CIM Systems Design
Area 2	BUS 520 - Managerial Finance IE 510 - Applied Engineering Economy IE 711 - Capital Investment Economic Analysis
Area 3	IE 514 - Manufacturing Product Engineering IE 716 - Automated Systems Engineering
Area 4	IE 723 - Production Planning, Scheduling and Inventory Control
Area 5	IE 754 - Logistics Engineering

III. Mechatronics Core (one from each area)

Area 1	MAE (WPS) 534 - Mechatronic Design ECE 456 - Mechatronics
Area 2	MAE 513 – Principles of Structural Vibration MAE 533 – Finite Element Method 1 MAE 742 – Design for Mechanical Assembly
Area 3	ECE(CSC) 460 – Digital Systems Interfacing ECE 561 - Embedded Systems Design ECE 711 – Analog Electronics ECE 713 – Digital Signal Processing
Area 4	CSC(ECE) 517 – Object-oriented Languages and Systems IE 716 – Automated Systems Engineering; I E 719 – CIM System Design
Area 5	ECE 437 – Distributed Real-Time Control Systems MAE 524 – Principles of Mechatronic Control

IV. Biomanufacturing Core (one from each area)

Area 1	CSC 510 - Software Engineering CSC 742 - Database Management Systems IE 719 - CIM Systems Design
Area 2	BUS 520 - Managerial Finance IE 711 - Capital Investment Economic Analysis
Area 3	IE 514 - Manufacturing Product Engineering IE 589V - Engineering Project Management
Area 4	IE 789C - Quality Engineering in Biomedical Applications
Area 5	IE 723 - Production Planning, Scheduling, and Inventory Control

GRADUATE COURSES

IMS 675 Manufacturing Systems Engineering Project
IMS 680 Master's Directed Study
IMS 685 Master's Supervised Teaching
IMS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
IMS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
IMS 690 Master's Examination

NCSU Graduate Catalog

International Studies

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
International Studies					Y		

GRADUATE FACULTY

Director of Graduate Programs:
H. H. Hobbs, Box 8102, 513.4389, heidi_hobbs@ncsu.edu, Political Sci. & Public Admin.

William Neal Reynolds Professor Emeritus: S. W. Buol
William Neal Reynolds Professor Sociology: M. D. Schulman

Professors: L. S. Bull, F. W. Cubbage, D. M. Daley, R. L. Moxley, J. K. Ocko, R. P. Patterson, M. A. Renkow, A. L. Schiller, J. C. H. Shih, F. J. Smith, M. S. Soroos, M. A. Witt Frese; ***Professors Emeriti:*** C. H. Carlton, E. W. Erickson; ***Associate Professors:*** W. A. Boettcher III, J. C. Dutton Jr., C. E. Griffin, H. H. Hobbs, M. A. Johnson, A. F. Khater, J. Kiwanuka-Tondo, R. C. Kochersberger Jr., N. Mitchell, R. S. Moog, R. F. Stephen, R. J. Thomson, J. M. Wallace III, S. T. Warren, S. B. Wiley; ***Assistant Professors:*** M. Struett

The Master of International Studies (MIS) is a 36-hour, non-thesis professional degree program that prepares students for careers in government service, non-profit administration, international businesses, and higher education administration in international student services and study abroad. Located in the School of Public and International Affairs, the MIS degree draws upon faculty and courses from colleges and departments across the university. Approximately half of the course work for the degree is devoted to developing international knowledge and competencies. The remaining coursework is comprised of regional, topical, professional or technical specializations that are designed by students in consultation with their faculty advisors.

Admission Requirements: Applicants must provide GRE scores in addition to other application materials required by the Graduate School.

Degree Requirements: The requirements for the MIS degree are as follows:

1. 36 credit hours of course work;
2. One course from each of the following groupings:

Group A - International Relations
PS 530 Seminar in International Relations
PS 533 Global Problems and Policy
HI 554 History of U.S. Foreign Relations, 1900-Present

Group B - Comparative Politics/Societies
PS 540 Seminar in Comparative Politics
PS 542 Western European Politics
PS 543 Latin America and Caribbean Politics
PS 545 Comparative Systems of Law and Justice
SOC 514 Developing Societies
SOC 727 Comparative Societies

Group C - International Law and Organization
PS 431 The United Nations and Global Order
PS 531 International Law
PS 536 Global Environmental Law and Policy

Group D - International Economy/Development
BUS 426 International Financial Management or ED 449 International Finance
EC 448 International Trade
ECG 540 Economic Development
PS 539 International Political Economy

Group E - Cross-cultural Communication
COM 523 International and Intercultural Communication
PSY 755 Cross-Cultural Research and Development

3. Individualized specialization of 12-15 hours. The specialization may be in a geographical region (e.g., Latin America, South Asia), an international topic (e.g., security, environment, sustainable development), a professional field (e.g., business, public administration, non-profit management), or a technical specialty (e.g., agriculture, information technology). The specialization may include an appropriate research methodology course, if recommended by the student's faculty advisory;

4. Capstone seminar (three hours) and oral presentation of work to faculty and peers;

5. A significant foreign work or study experience;

6. Reading/listening/speaking competency in a foreign language.

GRADUATE COURSES

MIS 598 Special Topics in International Studies
MIS 601 Colloquium in International Studies
MIS 630 Independent Study
MIS 651 Internship in International Studies
MIS 685 Master's Supervised Teaching
MIS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
MIS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
MIS 690 Master's Examination

Landscape Architecture

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Landscape Architecture					Y		

GRADUATE FACULTY

G. Bressler, ***Department Head***

Director of Graduate Programs:
F. H. Magallanes, Box 7701, 515.8348, f_magallanes@ncsu.edu, Landscape Architecture

Professors: G. Bressler, A. R. Brown-Graham, R. C. Moore, A. R. Rice; ***Professors Emeriti:*** A. R. Abbate, R. R. Wilkinson; ***Associate Professors:*** F. H. Magallanes; ***Research Associate Professors:*** J. D. Tomlinson; ***Assistant Professors:*** K. Boone, L. A. Milburn; ***Visiting Assistant Professors:*** C. Delcambre, R. Swink; ***Adjunct Assistant Professors:*** J. Sherk, C. F. Van Der Wiele

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: H. A. Devine; ***Associate Professors:*** T. H. Shear

Course offerings or research facilities are available in the following areas: site planning and design, landscape history, urban public spaces, community design, regional design, resource management, outdoor learning environments, international urban and rural landscapes, and specialized landscapes.

Admission Requirements: The best-qualified applicants are accepted up to the maximum number of spaces that are available for new students. Exceptions to the minimum 3.00 GPA may be made for students with special backgrounds, abilities and interests.

Master's Degree Requirements.
I. Accredited First Professional Degree in Landscape Architecture: Candidates follow an 82-hour sequence of courses over a six-semester period. Three semesters of the program of study are determined by the required curriculum. The last three semesters of study are outlined by the student's Chair of the Department, Director of Graduate Programs, and/or advisor. Research and case studies lead to the final project and design application. The investigative direction is set in collaboration with the chair of the faculty committee. A formal presentation of findings to the faculty, student body and local professionals is required. The summary research and project report must be submitted to the College of Design faculty to meet the graduation requirements. *II. Advanced Studies in Landscape Architecture:* Candidates with an accredited undergraduate Landscape Architecture degree follow a 48-hour sequence of courses. Twenty-seven hours of electives are chosen through advising with the Director of Graduate Programs, advisors and faculty committee. Comprehensive research work is required for a final project with a final report is required. A formal presentation of findings to the faculty, student body and local professionals is also required.

Other Relevant Information: Students have the option of including a graduate minor in their course of studies. Minors can be in any other graduate program offered at NC State, UNC-CH and Duke University. Some examples of graduate minors are: natural resources, parks, recreation and tourism management, architecture, education, planning, civil engineering, and art and design. The College of Design includes the Center for Universal Design, the Office of Research, Extension & Engagement, and the Natural Learning Initiative.

GRADUATE COURSES

LAR 500 Landscape Design Studio
LAR 501 Landscape Architecture Introduction Studio
LAR 502 Landscape Description Studio
LAR 503 Landscape Architecture Construction Studio
LAR 505 Landscape Architecture Final Project Studio
LAR 510 Graphics for Landscape Architects
LAR 511 Community Design Policy
LAR 512 Landscape Resource Management
LAR 521 Values, Theory and Methods of Landscape Architecture
LAR 522 Research Methods and Final Project Development
LAR 530 Advanced Site Planning
LAR 533 Plants and Design
LAR 565 International Landscape Architecture Design Studio
LAR 566 Landscape Architecture International Issues
LAR(ARC) 576/DDN 776 Community Design
LAR(ARC) 577/DDN 777 Sustainable Communities
LAR(ARC) 578/DDN 778 Ecological Design
LAR 579/DNN 779 Human Use of the Urban Landscape
LAR 582 Special Topics in Landscape Architecture
LAR 630 Independent Study
LAR 679 Final Studio Project
LAR 685 Master's Supervised Teaching
LAR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
LAR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
LAR 690 Master's Examination
LAR 697 Final Research Project

NCSU Graduate Catalog

Liberal Studies

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Liberal Studies				Y			

GRADUATE FACULTY

Director of Graduate Programs:
R. C. Kochersberger Jr., Box 7107, 515.4159, rckeg@unity.ncsu.edu, Interdisciplinary Programs

Professors: R. A. Waschka II; ***Associate Professors:*** C. C. Brookins, D. H. Crumbley, P. W. Hamlett, S. T. Warren; ***Visiting Assistant Professors:*** J. C. Kramer

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: L. H. MacKethan, R. P. Patterson; ***Associate Professors:*** W. A. Jackson, III

The Master of Arts in Liberal Studies (MALS) program is an interdisciplinary graduate program administered by the College of Humanities and Social Sciences. This is a broad, interdisciplinary program of part-time or full-time graduate study that integrates and expands the student's knowledge and awareness and that is geared to the student's personal interests. Each student, in consultation with an academic advisor, designs an individual program of study around an interdisciplinary theme or topic that is of intrinsic interest to the student or that relates to the student's professional or vocational interests. Students take graduate courses across a range of NC State departments as well as MALS seminars designed specifically for the program.

Admissions Requirements: Students entering the Master's program in liberal studies must have an undergraduate degree. In addition to the material required by the Graduate School, students applying are asked to submit a statement describing their objectives in doing a degree in liberal studies and a writing sample. GRE scores are not required. All applicants are interviewed.

Master's Degree Requirements: Thirty hours of course work made up of (1) a minimum of three MALS seminars, (2) 18 hours representing the student's interdisciplinary theme or concentration, and (3) a three-hour culminating project. Examples of concentrations that are well supported by graduate courses in the NC State curriculum are: science, technology and society, the American experience and leadership.

Student Financial Support: The MALS Program normally has financial aid available for students in the form of Teaching Assistantships. Each semester there about three positions that are awarded to students on a competitive basis. Teaching Assistantships are not available during the Summer Sessions.

GRADUATE COURSES

MLS 501 Seminar in Liberal Studies
MLS 630 Independent Study
MLS 676 Independent Project
MLS 685 Master's Supervised Teaching
MLS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
MLS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
MLS 690 Master's Examination

NCSU Graduate Catalog

Marine, Earth and Atmospheric Sciences

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Marine, Earth, and Atmospheric Sciences	Y		Y				

GRADUATE FACULTY

J. C. Fountain, ***Department Head***

Director of Graduate Programs:
G. S. Janowitz, Box 8208, 515.7837, janowitz@ncsu.edu, Marine, Earth & Atmos. Science

Scholar in Residence: R. R. Braham

Professors: V. P. Aneja, S. P. S. Arya, D. J. DeMaster, D. B. Eggleston, R. V. Fodor, J. C. Fountain, J. P. Hibbard, G. S. Janowitz, D. Kamykowski, J. M. Morrison, L. J. Pietrafesa, S. Raman, F. H. M. Semazzi, T. G. Wolcott, L. Xie; ***Research Professors:*** S. Rebach, R. H. Tolson; ***Visiting Professors:*** T. F. Clark; ***Adjunct Professors:*** N. E. Blair, S. W. Chang, W. J. Cooper, S. K. LeDuc, B. V. Miller, S. T. Rao, R. Reynolds, R. Rotunno; ***Professors Emeriti:*** H. S. Brown, V. V. Cavaroc Jr., J. M. Davis, T. S. Hopkins, L. J. Langfelder, C. J. Leith, D. A. Russell, W. J. Saucier, C. W. Welby; ***Associate Professors:*** D. P. Genereux, R. He, M. M. Kimberley, G. M. Lackmann, E. L. Leithold, P. Shaw, W. J. Showers; ***Research Associate Professors:*** E. N. Buckley; ***Adjunct Associate Professors:*** B. S. Ferrier, M. L. Kaplan, J. C. Reid, C. R. Tomas, R. W. Wiener; ***Associate Professors Emeriti:*** C. E. Knowles, A. J. Riordan, E. F. Stoddard, G. F. Watson, D. L. R. Wolcott; ***Assistant Professors:*** A. Aiyyer, D. R. Bohnenstiehl, J. A. Clarke, C. N. Cudaback, J. Liu, N. Meskhidze, M. Parker, M. H. Schweitzer, S. Yuter, Y. Zhang; ***Research Assistant Professors:*** J. Lin, H. Mitasova; ***Visiting Assistant Professors:*** C. Thomas; ***Adjunct Assistant Professors:*** R. E. Barrick, L. D. Carey, J. J. Charney, D. M. Checkley Jr., M. Childress, D. R. Corbett, A. S. Frankel, A. F. Hanna, J. A. Hare, T. Holt, C. Jang, G. J. Kirkpatrick, A. J. Lewitus, J. E. McNinch, D. S. Niyogi, S. B. Phillips, P. A. Roelle, R. C. Tacker, Q. Tong

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: J. M. Burkholder, J. M. Miller; ***Professors Emeriti:*** B. J. Copeland

Graduate disciplines in atmospheric science, geology and marine sciences are offered. Within marine sciences the subdisciplines of biological, chemical, geological and physical oceanography are recognized by the profession.

Admission Requirements: A bachelor's degree with research experience or a master's degree is required for entry into the Ph.D. program. The GRE Subject Test scores are required only for applicants in biological oceanography. A bachelor's degree in a science, mathematics or engineering is required for entry into the M.S. program in atmospheric science, geology, and biological, chemical, geological or physical oceanography. Undergraduate field camp is required of all students in the M.S. program in geology; this requirement may be fulfilled before or after admission. An M.S. degree with a non-thesis option for students on leave for a fixed period from government positions is available and admission to this option must be requested at the time of application.

Master's Degree Requirements: The M.S. degree requires a minimum of 30 credit hours. Specific course requirements are determined by the advisory committee of each student. However, MEA 601 Seminar is required of all M.S. students no later than the third semester in residence. Marine science students are required to take core courses in two of the three subdisciplines other than their own.

Doctoral Degree Requirements: Specific courses are determined by the student's advisory committee. Registration in seminar, MEA 801, is required of all Ph.D. students no later than the fourth semester in residence. Marine science students are required to take core courses in all three subdisciplines other than their own; this requirement may be fulfilled at the M.S. level.

Student Financial Support: Research and teaching assistantships are available.

Other Relevant Information: Students are assigned initial advisors upon admission. It is the student's responsibility to secure the consent of a faculty member to serve as the permanent advisor who will chair or co-chair the advisory committee.

GRADUATE COURSES IN COMMON TO ALL MEA STUDENTS

MEA 601 Seminar
MEA 685 Master's Supervised Teaching
MEA 690 Master's Examination
MEA 693 Master's Supervised Research
MEA 695 Master's Thesis Research
MEA 696 Summer Thesis Research
MEA 699 Master's Thesis Preparation
MEA 801 Seminar
MEA 885 Doctoral Supervised Teaching
MEA 890 Doctoral Preliminary Examination
MEA 893 Doctoral Supervised Research
MEA 895 Doctoral Dissertation Research
MEA 896 Summer Dissertation Research
MEA 899 Doctoral Dissertation Preparation

GRADUATE COURSES

Atmospheric Science

MEA 510 Air Pollution Meteorology
MEA 512 Satellite Meteorology
MEA 513 Radar Meteorology
MEA 514 Advanced Physical Meteorology
MEA(CE) 579 Principles of Air Quality Engineering
MEA 593 Special Topics in Atmospheric Science
MEA 613 Special Topics in Atmospheric Science
MEA 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
MEA 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
MEA 700 Environmental Fluid Mechanics
MEA 702 Advanced Cloud and Precipitation Physics
MEA 703 Atmospheric Aerosols
MEA 705 Dynamic Meteorology
MEA 706 Meteorology of the Biosphere
MEA 707 Planetary Boundary Layer
MEA 708 Atmospheric Turbulence
MEA 710 Atmospheric Dispersion
MEA 712 Mesoscale Modeling
MEA 713 Mesoscale Dynamics
MEA 714 Atmospheric Convection
MEA 715 Dynamics of Mesoscale Precipitation System
MEA 716 Numerical Weather Prediction
MEA 717 Advanced Weather Analysis
MEA 719 Climate Modeling
MEA 720 Coastal Meteorology
MEA 721 Air-Sea Interaction
MEA(MAE) 725 Geophysical Fluid Mechanics
MEA(MAE) 726 Advanced Geophysical Fluid Mechanics
MEA(CE) 779 Advanced Air Quality

MEA 793 Advanced Special Topics in Atmospheric Science
MEA 813 Special Topics in Atmospheric Science

Earth Science

MEA 570 Geological Oceanography
MEA 574 Advanced Igneous Petrology
MEA 575 Advanced Metamorphic Petrology
MEA 576 Applied Sedimentary Analysis
MEA 577 Electron Microprobe Analysis of Geologic Material
MEA 578 Depositional Environments and Lithostratigraphy
MEA 585 Physical Hydrogeology
MEA 592 Special Topics in Earth Science
MEA 599 Regional Geology of North America
MEA 612 Special Topics in Earth Science
MEA 758 Laboratory and Field Methods for Investigation of the Seabed
MEA 759 Organic Geochemistry
MEA 760 Biogeochemistry
MEA 763 Geochemistry
MEA 764 Sedimentary Geochemistry
MEA 785 Chemical Hydrogeology
MEA 788 Advanced Structural Geology
MEA 789 Topics in Appalachian Geology
MEA 790 Geotectonics
MEA 792 Advanced Special Topics in Earth Science
MEA 794 Regional Tectonics
MEA 795 Photogeology and Remote Sensing
MEA 796 Exploration and Engineering Geophysics
MEA 812 Special Topics in Earth Science

Marine Science

MEA 540 Principles of Physical Oceanography
MEA(ZO) 549 Principles of Biological Oceanography
MEA 554 Marine Physical-Biological Interactions
MEA 560 Chemical Oceanography
MEA 562 Marine Sediment Transport
MEA 570 Geological Oceanography
MEA 573 Principles of Chemical Oceanography
MEA 591 Special Topics in Marine Science
MEA 611 Special Topics in Marine Science
MEA 615 Graduate At-Sea Laboratory
MEA 700 Environmental Fluid Mechanics
MEA 713 Mesoscale Wave Dynamics
MEA 721 Air-Sea Interaction
MEA(MAE) 725 Geophysical Fluid Mechanics
MEA(MAE) 726 Advanced Geophysical Fluid Mechanics
MEA 735 Fourier Analysis of Geophysical Data
MEA 741 Synoptic Physical Oceanography
MEA(CE) 742 Gravity Wave Theory I
MEA 743 Ocean Circulation
MEA 744 Dynamics of Shelf Circulation
MEA 745 the Physical Dynamics of Estuaries
MEA (ZO) 750 Marine Benthic Ecology
MEA 752 Marine Plankton Ecology
MEA(ZO) 754 Advances in Marine Community Ecology
MEA(ZO) 756 Ecology of Fishes
MEA 758 Laboratory and Field Methods for Investigation of the Seabed
MEA 759 Organic Geochemistry
MEA 760 Biogeochemistry
MEA 762 Marine Geochemistry
MEA 767 Continental Margin Sedimentation
MEA 791 Advanced Special Topics in Marine Science
MEA 811 Special Topics in Marine Science

NCSU Graduate Catalog

Materials Science and Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Materials Science and Engineering	Y		Y		Y		

GRADUATE FACULTY

J. M. Rigsbee, ***Department Head***

Director of Graduate Programs:
R. O. Scattergood, Box 7907, 515.7843, ron_scattergood@ncsu.edu, Materials Science & Engineering

Distinguished Research Professor: J. J. Cuomo
John C. Fan Family Distinguished Chair in Materials Science and Engineering: J. Narayan
Kobe Steel Distinguished University Professor Emeritus: R. F. Davis

Professors: C. M. Balik, D. W. Brenner, K. Dawes, N. A. El-Masry, A. I. Kingon, C. C. Koch, K. L. Murty, J. M. Rigsbee, G. A. Rozgonyi, P. E. Russell, R. O. Scattergood, Z. Sitar, R. J. Spontak; ***Research Professors:*** M. O. Aboelfotoh, R. B. Benson Jr., C. R. Guarnieri; ***Adjunct Professors:*** J. T. Prater, R. R. Reeber, F. Shimura; ***Professors Emeriti:*** K. J. Bachmann, H. Conrad, A. Fahmy, K. L. Moazed, H. Palmour III, H. H. Stadelmaier; ***Associate Professors:*** G. J. Duscher, J. Kasichainula, J. Maria, Y. T. Zhu; ***Research Associate Professors:*** A. Grouverman; ***Visiting Associate Professors:*** D. P. Griffis; ***Adjunct Associate Professors:*** P. G. Kotula, R. J. Narayan, V. V. Zhirnov; ***Associate Professors Emeriti:*** J. V. Hamme; ***Assistant Professors:*** M. A. L. Johnson, T. M. Luo, C. L. Reynolds Jr., J. B. Tracy, Y. G. Yingling; ***Research Assistant Professors:*** R. R. Collazo, D. J. Lichtenwalner

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: D. E. Aspnes, G. Lucovsky, S. M. Bedair, H. H. Lamb, G. N. Parsons; ***Professors Emeriti:*** J. A. Bailey, K. S. Havner

Materials and materials limitations pervade all of the engineering and high technology fields that are an integral part of our society. Graduate programs in this department focus on understanding the structure, structure modification and properties of materials and the development of new or improved materials and advanced processing methods that are critical links between the design and the realization of new systems.

Admission Requirements: In addition to the general admission requirements as set by the Graduate School, the department requires submission of GRE scores. Non-native English speakers also require a minimum TOEFL score as established by the Graduate School.

Master's Degrees Requirements: The minimum requirements for the Master of Materials Science and Engineering degree are 33 credit hours and 30 credit hours for the Option B. The M.S. degree has the minimum requirement of 30 credit hours including six credit hours for research.

Doctoral Degree Requirements: The minimum requirements for the doctoral degree are 72 credit hours including 20 to 30 credit hours for research and 12 credit hours in one or more supporting fields of which no more than three credit hours may be at the 400 level.

Student Financial Support: Students in the graduate program normally receive financial support in the form of research or teaching assistantships or fellowships.

Other Relevant Information: The department reflects the interdisciplinary nature of the field of Materials Science and Engineering. A substantial number of current graduate students majored in fields other than but related to materials, and the department has a significant number of associated graduate faculty from other departments supervising thesis and dissertation research.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MSE 500 Modern Concepts in Materials Science
MSE(NE) 509 Nuclear Materials
MSE 531 Physical Metallurgy I
MSE(MAE) 539 Advanced Materials
MSE 540 Processing of Metallic Materials
MSE 545 Ceramic Processing
MSE 556 Composite Materials
MSE 560 Microelectronic Materials Science and Technology
MSE(TC) 561 Organic Chemistry of Polymers
MSE 575 Polymer Technology and Engineering
MSE(BUS) 576 Technology Evaluation and Commercialization Concepts
MSE(BUS) 577 High Technology Entrepreneurship
MSE(BUS) 578 Implementing Technology Commercialization Strategies
MSE 601 Seminar
MSE 685 Master's Supervised Teaching
MSE 690 Master's Examination
MSE 693 Master's Supervised Research
MSE 695 Master's Thesis Research
MSE 696 Summer Thesis Research
MSE 699 Master's Thesis Preparation
MSE 701 Diffusion and Mass Transport Processes in Solids
MSE 702 Defects in Solids
MSE 704 Electrical, Optical and Magnetic Properties of Materials
MSE 705 Mechanical Behavior of Engineering Materials
MSE 706 Phase Transformations and Kinetics
MSE(CH) 707 Chemical Concepts in Materials Science and Engineering
MSE 708 Thermodynamics of Materials
MSE 710 Elements of Crystallography and Diffraction
MSE 711 Stereology and Image Analysis
MSE 712 Scanning Electron Microscopy
MSE 715 Transmission Electron Microscopy
MSE 720 Advanced Crystallography and Diffraction
MSE 721 Theory and Structure of Amorphous Materials
MSE 722 Advanced Scanning Electron Microscopy and Surface Analysis
MSE 723 Theory and Structure of Metallic Materials
MSE(MAE) 731 Materials Processing by Deformation
MSE(MAE) 732 Fundamentals of Metal Machining Theory
MSE 733 Advanced Ceramic Engineering Design
MSE 741 Principles of Corrosion
MSE 751 Thin Film and Coating Science and Technology I
MSE 752 Thin Film and Coating Science and Technology II
MSE 753 Advanced Mechanical Properties of Materials
MSE 760 Materials Science Processing for Semiconductor Devices
MSE(CHE) 761 Polymer Blends and Alloys
MSE(TC) 762 Physical Chemistry of High Polymers - Bulk Properties
MSE 770 Defects, Diffusion and Ion Implantation in Semi-conductors
MSE(CH,TC) 772 Physical Chemistry of High Polymers - Solution Properties
MSE(NE) 773 Computer Experiments in Materials and Nuclear Engineering
MSE 775 Structure of Semicrystalline Polymers
MSE 791 Advanced Topics in Materials Science and Engineering
MSE 792 Advanced Topics in Materials Science and Engineering
MSE 795 Advanced Materials Experiments
MSE 801 Seminar
MSE 885 Doctoral Supervised Teaching
MSE 890 Doctoral Preliminary Examination

MSE 893 Doctoral Supervised Research
MSE 895 Doctoral Dissertation Research
MSE 896 Summer Dissertation Research
MSE 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Mathematics, Science and Technology Education

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Mathematics Education	Y		Y			Y	
Science Education	Y		Y			Y	
Technology Education		Y	Y			Y	

GRADUATE FACULTY

J. E. Penick, ***Department Head***

Directors of Graduate Programs:
H. S. Lee, Box 7801, 513.3544, hollylynne@ncsu.edu, Mathematics Education
J. H. Wheatley, Box 7801, 513.7168, jack_wheatley@ncsu.edu, Science Education
V. W. DeLuca, Box 7801, 515.1750, william_deluca@ncsu.edu, Technology Education

Moore Distinguieshed Professor: J. Confrey

Professors: S. B. Berenson, W. J. Haynie III, M. G. Jones, J. E. Penick, L. V. Stiff; ***Professors Emeriti:*** D. A. Adams, N. D. Anderson, L. M. Clark, J. K. Coster, D. M. Hanson, J. R. Kolb; ***Associate Professors:*** T. J. Branoff, G. S. Carter, A. C. Clark, V. W. DeLuca, K. Hollebrands, K. S. Norwood, J. C. Park, R. E. Peterson, J. H. Wheatley, E. N. Wiebe; ***Research Associate Professors:*** H. S. Stubbs; ***Visiting Associate Professors:*** T. Oppewal; ***Associate Professors Emeriti:*** W. M. Waters Jr., L. W. Watson, R. E. Wenig; ***Assistant Professors:*** L. Annetta, M. Blanchard, J. R. Busby, J. V. Ernst, K. S. Keene, H. S. Lee, B. Matthews, A. McCulloch, E. Parsons, T. E. Varnado; ***Visiting Assistant Professors:*** A. Y. Scales; ***Assistant Professors Emeriti:*** J. L. Crow, W. J. Vander Wall

The Department of Mathematics, Science and Technology Education offers graduate programs that lead to the degrees of Master of Science, Master of Education, Doctor of Education, and Doctor of Philosophy. Students take courses in their educational specialty, in general professional education, and in mathematics, science, or technology cognate areas including: biological sciences, chemistry, computer science, earth science, interdisciplinary science, mathematics, physics, or statistics.

Master's programs are offered leading to North Carolina M-licensure as a teacher of mathematics, science, or technology at grades 6-9 and/or 9-12 for those who have an initial license. Programs are also available for those seeking advanced graduate-level certification as a teacher. Students may choose a program to prepare for teaching careers in post-secondary education.

Admission Requirements: Applicants for all of the M.S., M.Ed., Ed.D., and Ph.D. degrees in mathematics, science or technology education must submit a completed application specific to the program. Please see the Mathematics, Science, and Technology website. The academic and professional background necessary for admission differs by specific program.

Master's Degree Requirements: The Master's Degree programs require a minimum of 36 semester hours of graduate work. Students who choose the M.S. degree substitute up to six semester hours of thesis research for part of the course load.

Doctoral Degree Requirements: The Ed.D. program requires a minimum of 90 semester hours of graduate work beyond the Baccalaureate Degree including a minimum of 12 semester hours of dissertation research. The Ph.D. program requires a minimum of 45 semester hours of course work and 9-12 semester hours of dissertation

research beyond the Master's Degree requirements. For both degrees, students may be required to supplement their course work with internships and/or other experiential activities to meet competencies.

Student Financial Support: A small number of teaching and research assistantships are available, and out-of-state tuition remission may be available for one year for students on assistantships.

GRADUATE COURSES

EMS 501 Readings in Science Education I
EMS 502 Readings in Science Education II
EMS 511 Implications of Mathematical Content, Structure and Processes for the Teaching of Mathematics in the Elementary School
EMS 512 Teaching and Learning Elementary and Middle Grades Mathematics
EMS 513 Teaching and Learning of Algebraic Thinking
EMS 514 Teaching and Learning of Geometric Thinking
EMS 521 Advanced Methods in Science Education I
EMS 522 Advanced Methods in Science Education II
EMS 531 Introduction to Research in Science Education
EMS 570 Foundations of Mathematics Education
EMS 573 Technology Tools for Science Teaching
EMS 575 Foundations of Science Education
EMS 577 Improving Classroom Instruction in Science
EMS 580 Advanced Applications of Technology in Mathematics Education
EMS 591 Special Problems in Mathematics Teaching
EMS 592 Special Problems in Science Teaching
EMS 621 Special Problems in Mathematics Teaching
EMS 622 Special Problems in Science Teaching
EMS 641 Practicum in Science and Mathematics Education
EMS 651 Internship in Mathematics, Science and Technology Education
EMS 675 Portfolio Development
EMS 685 Master's Supervised Teaching
EMS 686 Teaching in College
EMS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
EMS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
EMS 690 Master's Examination
EMS 692 Master's Research Project
EMS 693 Master's Supervised Research
EMS 695 Master's Thesis Research
EMS 696 Summer Thesis Research
EMS 699 Master's Thesis Preparation
EMS 703 Teaching Mathematics and Science in Higher Education
EMS 704 Curriculum Development and Evaluation in Science and Mathematics
EMS 705 Education and Supervision of Teachers of Mathematics and Science
EMS 709 Seminar in Occupational Education
EMS 730 Trends and Issues in Science Education
EMS 731 Fundamentals of Research in Science Education: Qualitative and Quantitative Inquiry
EMS 732 Theoretical and Critical Perspectives of Science Education
EMS 770 Foundations of Mathematics Education
EMS 775 Foundations of Science Education
EMS 777 Improving Classroom Instruction in Science
EMS 786 Teaching in College
EMS 792 Special Problems in Mathematics Teaching
EMS 794 Special Problems in Science Teaching
EMS 797 Special Topics
EMS 802 Seminar in Mathematics Education
EMS 803 Seminar in Science Education
EMS 821 Special Problems in Mathematics Teaching
EMS 822 Special Problems in Science Teaching
EMS 832 Research Applications in Science Education
EMS 841 Practicum in Science and Mathematics Education
EMS 851 Internship in Mathematics, Science and Technology Education
EMS 885 Doctoral Supervised Teaching
EMS 890 Doctoral Preliminary Examination

EMS 892 Doctoral Research Project
EMS 893 Doctoral Supervised Research
EMS 895 Doctoral Dissertation Research
EMS 896 Summer Dissertation Research
EMS 899 Doctoral Dissertation Preparation
TED 530 Foundations in Teaching Technology
TED 532 Current Trends and Issues in Graphic Education
TED 534 Instructional Design in Technology and Technology Education
TED 536 Scientific and Technical Visualization: Theory and Practice
TED 551 Technology Education: A Discipline
TED 552 Curricula for Emerging Technologies
TED 555 Developing and Implementing Technology Education
TED 556 Laboratory Management and Safety in TED
TED 558 Teaching Creative Problem Solving
TED 601 Practicum in Technology Education
TED 610 Special Topics in Technology Education
TED 621 Special Problems in Technology Education
TED 641 Internship in Technology Education
TED 646 Field-based Research in Technology Education
TED 655 Internship in Graphic Communications Education
TED 685 Master's Supervised Teaching
TED 690 Master's Examination
TED 692 Research Project in Technology Education
TED 693 Master's Supervised Research
TED 695 Master's Thesis Research
TED 709 Seminar in Technology Education
TED 751 Technology Education: A Discipline
TED 752 Curricula for Emerging Technologies
TED 755 Developing and Implementing Technology Education
TED 756 Planning of Change in Technology Education
TED 757 Leadership Development in Technology Education
TED 758 Teaching Creative Problem Solving
TED 801 Practicum in Technology Education
TED 810 Special Topics in Technology Education
TED 821 Special Problems in Technology Education
TED 892 Research Projects in Occupational Education
TED 895 Doctoral Dissertation Research
TED 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Mechanical and Aerospace Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Aerospace Engineering	Y		Y				
Mechanical Engineering	Y		Y		Y		

GRADUATE FACULTY

R. D. Gould, ***Interim Department Head***

Director of Graduate Programs:
R. T. Nagel, Box 7910, 515.5283, nagel@eos.ncsu.edu, Mechanical & Aerospace Engineering

Graduate Alumni Distinguished Professor: H. A. Hassan

Professors: F. R. DeJarnette, T. A. Dow, H. M. Eckerlin, J. R. Edwards Jr., R. D. Gould, R. F. Keltie, C. Kleinstreuer, J. W. Leach, D. S. McRae, R. T. Nagel, P. I. H. Ro, W. L. Roberts IV, L. M. Silverberg, J. S. Strenkowski, J. F. Tu, F. Yuan, M. A. Zikry; ***Research Professors:*** J. S. Stewart, R. H. Tolson; ***Adjunct Professors:*** J. P. Archie Jr., B. F. Blackwell, N. T. Frink, C. S. Kim, W. P. Linak, M. N. Noori, T. D. Scharton, J. Y. Wu; ***Professors Emeriti:*** E. M. Afify, J. A. Bailey, F. J. Hale, F. D. Hart, T. H. Hodgson, J. C. Mulligan, J. N. Perkins, L. H. Royster, F. O. Smetana, F. Y. Sorrell Jr., C. F. Zorowski; ***Associate Professors:*** M. A. Boles, G. D. Buckner, P. B. Corson, T. Echekki, J. W. Eischen, A. Gopalarathnam, C. E. Hall Jr., E. C. Klang, A. V. Kuznetsov, H. Luo, K. M. Lyons, A. P. Mazzoleni, A. Rabiei, M. K. Ramasubramanian, S. Seelecke, F. Wu; ***Research Associate Professors:*** Z. Zhang; ***Adjunct Associate Professors:*** J. H. Hebrank, G. A. Truskey; ***Assistant Professors:*** T. Fang, N. Ma, G. Ngaile, K. J. Peters, S. Terry, T. Zeng, Y. Zhu; ***Visiting Assistant Professors:*** A. O. Hobbs; ***Adjunct Assistant Professors:*** J. A. Cooke, P. A. Cooper

Course offerings and research programs are available in the following four thrust areas: (1) aerodynamics, fluid mechanics and propulsion; (2) dynamics, vibration and controls; (3) structural mechanics and materials; and (4) thermal sciences and energy systems. Sub-areas include: fluid mechanics, stability, transition and turbulence, gas dynamics and aerodynamics, reactive and multiphase flows, aeroelasticity, CFD, acoustics, vibrations, machine design and dynamics, adaptive structures, control and system identification, mechatronics and smart systems, active materials and auto-adaptive structures, manufacturing and automation, precision engineering, composite materials, elasticity, plasticity, and fracture mechanics, materials processing and tribology, thermodynamics, energy conversion and renewable energy, heat and mass transfer, combustion, atomization and sprays.

Admission Requirements: An applicant to the master's program must be a graduate of an accredited undergraduate program with a B.S. degree in either mechanical or aerospace engineering. Graduates of other accredited programs in engineering, physical sciences and mathematics may be considered but will be required to make up undergraduate deficiencies without graduate credit. Provisional admissions, as well as exceptions, are sometimes granted under special circumstances. The most qualified applicants are accepted first. Applicants to the Ph.D. program must have met the M.S. admission requirements, completed the M.S. degree in mechanical engineering or aerospace engineering and additionally must satisfy the Ph.D. admissions requirements.

Master's Degree Requirements: The thesis-option M.S. degree programs in mechanical engineering and aerospace engineering require 24 hours of course credit and six hours of thesis research. The non-thesis M.S. degree programs in mechanical engineering and aerospace engineering require 27 hours of course credit and a three credit-hour project. The non-thesis M.S. degree programs in mechanical engineering and aerospace

engineering are offered on campus and off campus through distance education.

Ph.D. Degree Requirements: A minimum of 54 hours of credit beyond the master's program is required.

Student Financial Support: Various types of assistantships and fellowships are available. Awards are made to the most qualified applicants first and generally are not available for all students.

Other Relevant Information: Each new student chooses an area of specialty, selects an advisor and committee, customizes a program of study and begins research in the first semester of residence. The Director of Graduate Programs acts as a temporary advisor initially and should be contacted with questions.

GRADUATE COURSES

MAE 501 Advanced Engineering Thermodynamics
MAE 503 Advanced Power Plants
MAE 504 Fluid Dynamics of Combustion I
MAE 505 Heat Transfer Theory and Applications
MAE 511 Advanced Dynamics with Applications to Aerospace Systems
MAE 513 Principles of Structural Vibration
MAE 514 Noise and Vibration Control
MAE 517 Instrumentation in Sound and Vibration Engineering
MAE 518 Acoustic Radiation I
MAE 521 Linear Control and Design for MIMO Systems
MAE 524 Principles of Mechantronic Control
MAE 525 Advanced Flight Vehicle Stability and Control
MAE 526 Inertial Navigation Analysis and Design
MAE 527 Mechanics of Machinery
MAE 528 Experimental Flight Testing
MAE 533 Finite Element Analysis I
MAE(WPS) 534 Mechatronics Design
MAE(ECE) 535 Design of Electromechanical Systems
MAE 537 Mechanics of Composite Structures
MAE 538 Smart Structures and Materials
MAE(MSE) 539 Advanced Materials
MAE 540 Advanced Air Conditioning Design
MAE 541 Advanced Solid Mechanics I
MAE 543 Fracture Mechanics
MAE 544 Real Time Robotics
MAE 545 Metrology for Precision Manufacturing
MAE 546 Photonic Sensor Applications in Structure
MAE 550 Foundations of Fluid Dynamics
MAE 551 Airfoil Theory
MAE 553 Compressible Fluid Flow
MAE 554 Hypersonic Aerodynamics
MAE 555 Aerodynamic Heating
MAE 557 Dynamics of Internal Fluid Flow
MAE 560 Computational Fluid Mechanics and Heat Transfer
MAE 561 Wing Theory
MAE 562 Physical Gas Dynamics
MAE 573 Hydrodynamic Stability and Transition
MAE 575 Advanced Propulsion Systems
MAE 586 Project Work in Mechanical Engineering
MAE 589 Special Topics in Mechanical Engineering
MAE 601 Mechanical and Aerospace Engineering Seminar
MAE 685 Master's Supervised Teaching
MAE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
MAE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
MAE 690 Master's Examination
MAE 693 Master's Supervised Research
MAE 695 Master's Thesis Research
MAE 696 Summer Thesis Research
MAE 699 Master's Thesis Preparation

MAE 702 Statistical Thermodynamics
MAE 704 Fluid Dynamics of Combustion II
MAE 707 Advanced Conductive Heat Transfer
MAE 708 Advanced Convective Heat Transfer
MAE 709 Advanced Radiative Heat Transfer
MAE 713 Analytical Methods in Structural Vibration
MAE 715 Nonlinear Vibrations
MAE 716 Random Vibration
MAE 718 Acoustic Radiation II
MAE 721 Robust Control with Convex Methods
MAE(MEA) 725 Geophysical Fluid Mechanics
MAE(MEA) 726 Advanced Geophysical Fluid Mechanics
MAE 727 Computational Methods in Structural Vibration
MAE 730 Modem Plasticity
MAE(MSE) 731 Materials Processing by Deformation
MAE(MSE) 732 Fundamentals of Metal Machining Theory
MAE 734 Finite Element Analysis II
MAE 741 Advanced Machine Design II
MAE 742 Mechanical Design for Automated Assembly
MAE 766 Computational Fluid Dynamics
MAE 770 Computation of Reacting Flows
MAE 774 Dynamics of Real Fluids I
MAE 775 Dynamics of Real Fluids II
MAE 776 Turbulence
MAE 777 Experimental Methods in Fluid Mechanics
MAE 778 Molecular Gas Dynamics I
MAE 779 Molecular Gas Dynamics II
MAE 789 Advanced Topics in Mechanical Engineering
MAE 801 Mechanical and Aerospace Engineering Seminar
MAE 885 Doctoral Supervised Teaching
MAE 890 Doctoral Preliminary Examination
MAE 893 Doctoral Supervised Research
MAE 895 Doctoral Dissertation Research
MAE 896 Summer Dissertation Research
MAE 899 Doctoral Dissertation Preparation

Microbiology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Microbial Biotechnology					Y		
Microbiology	Y		Y		Y		

GRADUATE FACULTY

E. S. Miller, ***Interim Department Head***

Director of Graduate Programs:
M. Hyman, Box 7615, 515.7814, michael_hyman@ncsu.edu, Microbiology

Professors: M. Flickinger, H. M. Hassan, S. M. Laster, G. H. Luginbuhl, J. M. Mackenzie Jr., E. S. Miller, I. T. D. Petty; ***Professors (USDA):*** P. E. Bishop; ***Adjunct Professors:*** I. A. Casas, S. R. Tove; ***Professors Emeriti:*** W. J. Dobrogosz, G. H. Elkan, L. W. Parks, J. J. Perry; ***Associate Professors:*** J. W. Brown, A. M. Grunden, M. Hyman, S. Kathariou; ***Adjunct Associate Professors:*** W. M. Casey, J. M. Ligon, S. H. Shore, J. L. Stephenson Jr.; ***Assistant Professors:*** L. Hamer, J. W. Olson, F. Scholle, M. L. Sikes; ***Research Assistant Professors:*** J. M. Bruno-Barcena

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: R. M. Kelly, T. R. Klaenhammer, D. T. Brown, F. J. Fuller, L. Jaykus, P. E. Orndorff, B. Sherry, J. C. H. Shih; ***Professors Emeriti:*** W. E. Kloos; ***Associate Professors:*** P. Arasu, F. L. de los Reyes, III; ***Associate Professors (USDA):*** R. G. Upchurch; ***Assistant Professors (USDA):*** F. Breidt

The Department of Microbiology is in the College of Agriculture and Life Sciences and has a unique blend of applied and basic research programs. The department offers courses of study and research leading to the Ph.D., M.S., Master of Microbiology (M.M.) and Master of Microbial Biotechnology (M.M.B.) degrees. The graduate program is designed to prepare individuals for careers in academic, industrial or research institute settings. Research in the department emphasizes study of fundamental biological processes, with several programs having important biotechnological, environmental and medical applications.

Admission Requirements: Applications are invited from individuals holding B.S. or M.S. degrees in the physical and life sciences. Applications should ideally be received in the department before January 15 to be considered for Fall semester admission. The Graduate Record Exam (GRE) should be taken sufficiently early so that scores can be submitted and evaluated along with the application. A written statement should describe the applicant's academic and career goals as well as their area of interest.

Master's Degree Requirements: The Master of Science (M.S.) is a research-oriented degree requiring 30 credit hours, a written thesis and at least one semester of laboratory instruction. For students wishing a more general educational background in microbiology without the thesis requirement, the Master of Microbiology (M.M.) degree is offered.

The Department also offers a non-thesis Master of Microbial Biotechnology (M.M.B.) degree. This degree program is a Professional Science Masters that combines concentrations in Microbiology, Business and Biotechnology. This program also can be combined with a Master of Business Administration (M.B.A.) offered through the College of Management.

Doctoral Degree Requirements: The Ph.D. program is designed for individuals desiring to pursue careers in

research and/or teaching. Students enroll in a core curriculum consisting of courses in metabolic regulation/physiology, virology, immunology, pathogenesis, and molecular genetics. In addition, the student, in consultation with and approval by his/her advisory committee, may select elective courses offered by the Department of Microbiology and by other departments on campus. In conjunction with the advisor, the student establishes a four-member faculty advisory committee to guide the research and academic program. At least one semester of laboratory instructorship is required. The final examination also includes a seminar presented by the candidate that is open to the university community.

Student Financial Support: Financial support for study towards Ph.D. and M.S. degrees is available in the form of teaching/research assistantships and competitive fellowships. All applications to the department are automatically considered for available assistantships. For highly qualified students, supplemental funds are frequently available.

Other Relevant Information: During the first semester, participation in the laboratory rotation program is required of all Ph.D. and M.S. students so that they become acquainted with departmental research programs, faculty and other graduate students. A faculty thesis advisor and laboratory research program are usually selected by the end of the first semester.

GRADUATE COURSES

MB(PB,PP) 501 Fungi and Their Interaction with Plants
MB(SSC) 532 Soil Microbiology
MB(PB,PP) 575 Introduction to Mycology
MB 590 Topical Problems
MB 601 Seminar
MB 610 Special Topics in Microbiology
MB 620 Special Problems
MB 624 Topical Problems
MB 670 Master's Laboratory Rotations
MB 680 Microbiology Research Presentations
MB 685 Master's Supervised Teaching
MB 686 Teaching Experience
MB 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
MB 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
MB 690 Master's Examination
MB 693 Master's Supervised Research
MB 695 Master's Thesis Research
MB 696 Summer Thesis Research
MB 699 Master's Thesis Preparation
MB 703 Microbial Diversity
MB 705 Biological Scanning Electron Microscopy
MB 710 Biological Transmission Electron Microscopy
MB 711 Ultramicrotomy for Life Sciences
MB 714 Microbial Metabolic Regulation
MB 718 Introductory Virology
MB(FS) 725 Fermentation Microbiology
MB(PB,GN,PP) 730 Fungal Genetics and Physiology
MB 735 Pathogenic Microbiology
MB(IMM) 751 Immunology
MB 771 Molecular Virology of Animal Viruses
MB(PB) 774 Phycology
MB(CBS,IMM) 783 Advanced Immunology
MB 790 Topical Problems
MB 801 Seminar
MB 810 Special Topics in Microbiology
MB 820 Special Problems
MB 824 Topical Problems
MB 870 Doctoral Laboratory Rotations
MB 880 Doctoral Microbiology Research Presentations
MB 885 Doctoral Supervised Teaching
MB 886 Teaching Experience

MB 890 Doctoral Preliminary Examination
MB 893 Doctoral Supervised Research
MB 895 Doctoral Dissertation Research
MB 896 Summer Dissertation Research
MB 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Natural Resources

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Natural Resources			Y		Y		

GRADUATE FACULTY

Directors of Graduate Programs:
F. H. Magallanes, Box 7701, 515.8348, f_magallanes@ncsu.edu, Landscape Architecture
J. C. Peel, Box 8004, 515.3663, judy_peel@ncsu.edu, Parks, Recreation & Tourism Mgmt.
S. T. Warren, Box 8008, 515.7996, sarah_warren@ncsu.edu, Forestry
T. J. Smyth, Box 7619, 515.2838, jot_smyth@ncsu.edu, Soil Science

Professors: R. C. Abt, A. Amoozegar, F. W. Cubbage, H. A. Devine, M. F. Floyd, B. Goldfarb, J. D. Gregory, E. Guthrie-Nichols, J. L. Havlin, S. Khorram, H. J. Kleiss, J. C. Peel, J. P. Roise, C. D. Siderelis, M. J. Vepraskas, M. G. Wagger, J. D. Wellman, W. E. Winner; ***Associate Professors:*** A. Attarian, G. B. Blank, H. Cheshire, L. D. Gustke, G. R. Hess, Y. Leung, F. H. Magallanes, R. L. Moore, C. E. Moorman, T. H. Shear, E. O. Sills, T. A. Steelman, S. T. Warren; ***Research Associate Professors:*** P. K. Baran; ***Assistant Professors:*** B. P. Bullock, A. James, S. A. C. Nelson

The natural resources program is an interdepartmental program designed to prepare students for positions in both private and public natural resource organizations. A selection of technical options couple core courses in natural resources issues and management with a series of related courses in a variety of related technical disciplines. The purpose of the natural resources core curriculum is to educate professionals at a Master's level who are well-versed in policy and regulation and who have skills in quantitative assessments. Currently approved technical options include: assessment and analysis, ecological restoration, economics and management, policy and administration, international resources, hydrology, and spatial information systems in the Department of Forestry and Environmental Resources; outdoor recreation management and spatial information systems in the Department of Parks, Recreation and Tourism Management; landscape architecture in the Department of Landscape Architecture; and soil science in the Department of Soil Science. With one exception, each option is available as either the M.S. in NR or as the non-thesis Master of NR. The soil science option is available only as the non-thesis degree.

Admissions Requirements: Students should have an undergraduate degree in natural resources or a related field. Experience in natural resources management and administration will be considered in lieu of an appropriate undergraduate degree. Admission is contingent upon meeting departmental requirements and acceptance by an advisor.

Master's Requirements: The M.S. degree requires a research thesis based on completion of a research project. The Master of NR degree requires a practical project which develops and demonstrates problem-solving skills. Students enrolled in the Department of Forestry and Environmental Resources must take FOR 603 in the first or second semester. The minimum number of credit hours varies by technical option, but is generally 36 credit hours including research or project credits and core courses.

Core Courses (16 credit hours)

NR 500 Natural Resource Management
NR 571 Current Issues in Natural Resource Policy
ST 5** Graduate-level statistics course
Six credits from technical option(s) other than the student's chosen option
Departmental seminar

GRADUATE COURSES

NR 500 Natural Resource Management
NR(FOR) 520 Watershed and Wetlands Hydrology
NR 521 Wetland Assessment, Delineation and Regulation
NR(PRT) 531 Introduction to Geographic Information Science
NR(PRT) 532 Principles of Geographic Information Science
NR(PRT) 533 Application Issues in GIS
NR(PRT) 535 Computer Cartography
NR(FOR) 536 Introduction to Visual Basic for GIS
NR 548 Historical Environments
NR 554 Data Management in Natural Resources
NR 571 Current Issues in Natural Resource Policy
NR 595 Special Topics in Natural Resources
NR 601 Graduate Seminar
NR 610 Special Topics in Natural Resources
NR 685 Master's Supervised Teaching
NR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
NR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
NR 690 Master's Examination
NR 693 Master's Supervised Research
NR 695 Master's Thesis Research
NR 696 Summer Thesis Research
NR 699 Master's Thesis Preparation

NCSU Graduate Catalog

Nuclear Engineering

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Nuclear Engineering	Y		Y		Y		

GRADUATE FACULTY

M. A. Bourham, ***Interim Department Head***

Director of Graduate Programs:
K. L. Murty, Box 7909, 515.3657, murty@ncsu.edu, Nuclear Engineering

Professors: M. A. Bourham, R. P. Gardner, J. G. Gilligan, K. L. Murty, P. J. Turinsky; ***Research Professors:*** B. W. Wehring; ***Adjunct Professors:*** R. M. Lindstrom, M. W. Mickael, M. S. Wechsler; ***Professors Emeriti:*** D. J. Dudziak, T. Elleman, R. L. Murray, K. Verghese; ***Associate Professors:*** J. M. Doster, A. I. Hawari, M. Yim; ***Adjunct Associate Professors:*** Y. R. Azmy, B. W. Wieland; ***Assistant Professors:*** D. Y. Anistratov, O. E. Hankins; ***Visiting Assistant Professors:*** H. S. Abdel-Khalik; ***Adjunct Assistant Professors:*** A. Sood; ***Interinstitutional Faculty:*** D. N. McNeilis

The discipline of nuclear engineering is concerned with the development of nuclear processes for energy production and with the applications of radiation for the benefit of society. Representative topics of investigation include analytic, computational and experimental research in the neutronics, materials, thermal-hydraulics and control aspects of fission reactors; radiation detection and measurement of basic physics parameters; waste management and radiological assessment; applications of radioisotopes and radiation in industry, medicine and science; and plasma, plasma engineering and design aspects of fusion reactors.

Admission Requirements: Bachelor's degree graduates in any of the fields of engineering or physical sciences may be qualified for successful advanced study in nuclear engineering. Prior experience or course work in nuclear physics, partial differential equations and basic reactor analysis is helpful but may be gained during the first semester of graduate study. GRE scores (general test) are usually needed for financial aid.

Master's Degree Requirements: A total of 30 credit hours which includes a minor (at least nine semester hours) is required for both the M.S. and MNE degrees. An engineering project is required for the MNE degree and research project for the M.S. degree.

Doctoral Degree Requirements: A total of 72 credit hours which includes a minor (typically 12 hours) is required. Students must pass a departmental qualifying exam that covers basic nuclear engineering material.

Student Financial Support: Teaching assistantships, research assistantships and fellowships are available for qualified applicants. Opportunities are also available for graduate traineeships with utility companies, reactor manufacturers and national laboratories providing a valuable combination of financial support and learning in the classroom, the research laboratory and on the job.

Other Relevant Information: The department has many excellent facilities including the one-megawatt PULSTAR fission reactor, ultra cold neutron source, neutron scattering facility, neutron radiography unit, neutron activation analysis laboratory, nuclear materials laboratory, plasma and plasma laboratories, instrumentation and controls equipment, radiation analyzers and tomography systems, and access to extensive computer facilities ranging from workstations to a supercomputer.

GRADUATE COURSES

NE 500 Nuclear Reactor Energy Conversion
NE 502 Reactor Engineering
NE 504 Radiation, Safety and Shielding
NE 505 Reactor Systems
NE(MSE) 509 Nuclear Materials
NE 511 Nuclear Physics for Engineers
NE 512 Nuclear Fuel Cycles
NE 520 Radiation and Reactor Fundamentals
NE(PY) 528 Introduction to Plasma Physics and Fusion Energy
NE 531 Nuclear Waste Management
NE 585 Management of Hazardous Chemical and Radioactive Wastes
NE 591, 592 Special Topics in Nuclear Engineering I, II
NE 601 Seminar
NE 685 Master's Supervised Teaching
NE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
NE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
NE 690 Master's Examination
NE 693 Master's Supervised Research
NE 695 Master's Thesis Research
NE 696 Summer Thesis Research
NE 699 Master's Thesis Preparation
NE 721 Nuclear Laboratory Fundamentals
NE 722 Reactor Dynamics and Control
NE 723 Reactor Analysis
NE 724 Reactor Heat Transfer
NE 726 Radioisotope Measurement Applications
NE 727 Nuclear Engineering Analysis
NE 730 Radiological Assessment
NE 732 Principles of Industrial Plasmas
NE 740 Laboratory Projects in Nuclear Engineering
NE 745 Plasma Generation and Diagnostics Laboratory
NE 746 Fusion Energy Engineering
NE 750 Laboratory Projects in Nuclear Engineering
NE 751 Nuclear Reactor Design Calculations
NE 752 Thermal Hydraulic Design Calculations
NE 753 Reactor Kinetics and Control
NE 755 Reactor Theory and Analysis
NE 757 Radiation Effects on Materials
NE 761 Radiation Detection
NE 762 Radioisotope Applications
NE 770 Nuclear Radiation Attenuation
NE 771 Advanced Nuclear Waste Management
NE(CE) 772 Environmental Exposure and Risk Analysis
NE(MSE) 773 Computer Experiments in Materials and Nuclear Engineering
NE(MA) 777 Exact and Approximate Solutions in Particle Transport Theory
NE 780 Magnetohydrodynamics and Transport in Plasmas
NE 781 Kinetic Theory, Waves and Non-linear Effects in Plasmas
NE 795, 796 Advanced Topics in Nuclear Engineering I, II
NE 801 Seminar
NE 885 Doctoral Supervised Teaching
NE 890 Doctoral Preliminary Examination
NE 893 Doctoral Supervised Research
NE 895 Doctoral Dissertation Research
NE 896 Summer Dissertation Research
NE 899 Doctoral Dissertation Preparation

Nutrition

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Nutrition	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
J. C. Allen, Box 7624, 513.2257, jon_allen@ncsu.edu, Nutrition

William Neal Reynolds Distinguished Professor and Director of Graduate Programs ANP and PSC: J. T. Brake
William Neal Reynolds Professor: J. Odle
William Neal Reynolds Professor Emeritus: H. E. Swaisgood

Professors: J. C. Allen, B. P. Alston-Mills, K. E. Anderson, L. C. Boyd, L. S. Bull, G. L. Catignani, P. C. Dunn, J. H. Eisemann, P. R. Ferket, J. L. Grimes, W. M. Hagler Jr., B. A. Hopkins, C. J. Lackey, J. W. McClelland, J. F. Ort, M. H. Poore, J. C. H. Shih, R. C. Smart, J. W. Spears, L. W. Whitlow; ***Professors Emeriti:*** L. W. Aurand, W. E. Donaldson, J. D. Garlich, R. W. Harvey, C. H. Hill, W. L. Johnson, J. R. Jones, R. D. Mochrie, S. J. Schwartz, G. H. Wise; ***Associate Professors:*** S. L. Ash, V. Fellner, G. B. Huntington, J. Luginbuhl, J. A. Moore, P. E. Mozdziak, P. D. Siciliano, E. van Heugten; ***Adjunct Associate Professors:*** R. J. Harrell; ***Assistant Professors:*** E. Oviedo-Rondon, S. E. Pratt

ASSOCIATE MEMBERS OF THE PROGRAM

Assistant Professors: M. Koci

The interdepartmental nutrition program consists of faculty from five departments (animal science, family and consumer sciences, food science, poultry science and toxicology). Students reside and conduct research in one of these departments under the direction of an appropriate advisor. Research in the nutrition program may be conducted with a variety of species and at levels ranging from the molecular to the whole animal. Research programs are primarily in the area of nutritional biochemistry or experimental animal nutrition (e.g. ruminants, swine, poultry, rodents, and other species).

Admission Requirement: To be considered for admission, a student should have a B.S. or M.S degree in a science-related area. Students for M.S. or Ph.D. should contact and be recommended by a prospective major faculty advisor in their area of interest prior to final admission.

Master's Degree Requirements: A minimum of 24 course credit hours and a thesis is required for M.S., 36 for Master of Nutrition.

Student Financial Support: Assistantships and fellowships are available on a competitive basis from the departments in which the advisor resides.

GRADUATE COURSES

NTR 500 Principles of Human Nutrition
NTR(ANS) 550 Applied Ruminant Nutrition
NTR(ANS,FS) 554 Lactation, Milk, and Nutrition
NTR(FS) 555 Exercise Nutrition
NTR 597 Master's Seminar

NTR 601 Master's Seminar
NTR 624 Topical Problems
NTR 625 Advanced Special Problems
NTR 685 Master's Supervised Teaching
NTR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
NTR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
NTR 690 Master's Examination
NTR 693 Master's Supervised Research
NTR 695 Master's Thesis Research
NTR 696 Summer Thesis Research
NTR 699 Master's Thesis Preparation
NTR 701 Protein and Amino Acid Metabolism
NTR(FS) 706 Vitamin Metabolism
NTR(ANS) 709 Energy Metabolism
NTR(FS) 710 Food Lipids
NTR(FS) 730 Human Nutrition
NTR(ANS,CBS,PHY) 764 Advances in Gastrointestinal Pathophysiology
NTR(ANS,PO) 775 Mineral Metabolism
NTR(ANS) 785 Digestion and Metabolism in Ruminants
NTR 797 Doctoral Seminar
NTR 801 Doctoral Seminar
NTR 824 Topical Problems
NTR 825 Advanced Special Problems
NTR 885 Doctoral Supervised Teaching
NTR 890 Doctoral Preliminary Examination
NTR 893 Doctoral Supervised Research
NTR 895 Doctoral Dissertation Research
NTR 896 Summer Dissertation Research
NTR 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Operations Research

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Operations Research	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
Y. Fathi, Box 7913, 515.6417, fathi@eos.ncsu.edu, Operations Research

Alan T. Dickson Distinguished University Professor: M. A. Rappa
Bank of America University Distinguished Professor: R. B. Handfield
Clipton A. Anderson Distinguished Professor: R. Uzsoy
James T. Ryan Prof of Industrial Engineering: T. J. Hodgson
University Professor: S. E. Elmaghraby
Walter Clark Chair Professor of IE and Director of Graduate Programs IE: S. Fang
William Neal Reynolds Professor: Z. Zeng

Professors: J. W. Baugh Jr., R. H. Bernhard, B. B. Bhattacharyya, E. D. Brill Jr., S. L. Campbell, M. Devetsikiotis, Y. Fathi, R. E. Hartwig, D. M. Holthausen Jr., I. Ipsen, K. Ito, C. T. Kelley, R. E. King, Z. Li, G. F. List, D. F. McAllister, N. G. Medhin, C. D. Meyer Jr., A. A. Nilsson, H. G. Perros, S. R. Ranjithan, S. D. Roberts, J. P. Roise, G. N. Rouskas, C. D. Savage, R. C. Smith, W. J. Stewart, M. W. Suh, H. T. Tran, I. Viniotis, M. A. V. Vouk, J. R. Wilson; ***Adjunct Professors:*** X. Chao, P. R. Wurman; ***Professors Emeriti:*** J. W. Bishir, W. Chou, J. C. Dunn, R. E. Funderlic, H. J. Gold, H. L. Nuttle; ***Associate Professors:*** K. T. Barletta, S. Ghosal, T. L. Honeycutt, J. A. Joines, M. G. Kay, T. W. Reiland, C. E. Smith, M. F. M. Stallmann, F. Wu, D. Zenkov; ***Adjunct Associate Professors:*** J. Taheri; ***Assistant Professors:*** R. T. Buche, R. Y. Chirkova, J. S. Ivy, T. Pang, K. Sivaramakrishnan, W. Wang, D. Warsing, T. Yu

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: M. P. Singh

Operations research is a graduate program of an interdisciplinary nature, governed by an administrative board and the program committee, and administered through the office of the program co-directors.

Admission Requirements: Applications are accepted from undergraduate majors in engineering and in physical and mathematical sciences who meet prerequisites in calculus and matrix-linear algebra, computer science, and statistics. A score on the GRE that is less than two years old is required if financial assistance is sought or if the student is transferring from another doctoral program.

Master's Degree Requirements: The Master of Operations Research degree is a terminal graduate degree for students who seek careers as OR practitioners in either the private or public sector. The M.S. degree is designed to prepare students for careers in research and development.

Doctoral Degree Requirements: The Ph.D. degree is intended for students to be research scientists in industry or teachers and researchers in academia. This degree requires 72 credit hours of course and research work beyond the Bachelor's degree. Undergraduate students with superior credentials may apply directly to the doctoral program and bypass the Master's degree. For students who have completed the Master's degree, typically 30 to 36 hours of additional course work are required. A departmental written qualifying examination is required. Please consult the OR website for more details of degree requirements.

Student Financial Support: Both teaching and research assistantships are available to qualified applicants. Award priority is given to Ph.D. then M.S. applicants. Outstanding students who are U.S. citizens and who shall be enrolled in the NC State Graduate School for the first time are eligible for the Engineering Dean's Graduate Fellowship Program.

CENTRAL GRADUATE COURSES

OR 501 Introduction to Operations Research
OR 502 Introduction to Systems Theory
OR(MA) 504 Introduction to Mathematical Programming
OR(IE,MA) 505 Linear Programming
OR 506 Algorithmic Methods in Nonlinear Programming
OR(CHE) 527 Optimization of Engineering Processes
OR(E,MA) 531 Dynamic Systems and Multivariable Control I
OR(CSC,MA) 565 Graph Theory
OR(CSC,ECE) 579 Introduction to Computer Performance Modeling
OR 591 Special Topics
OR 601 Seminar
OR 610 Special Topics
OR 615 Advanced Special Topics
OR 652 Practicum in Operations Research
OR 685 Master's Supervised Teaching
OR 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
OR 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
OR 690 Master's Examination
OR 693 Master's Supervised Research
OR 695 Master's Thesis Research
OR 696 Summer Thesis Research
OR 699 Master's Thesis Preparation
OR 705 Large Scale Linear Programming Systems
OR(MA,ST) 706 Nonlinear Programming
OR(IE,MA) 708 Integer Programming
OR(IE) 709 Dynamic Programming
OR 710 Advanced Dynamic Programming
OR(MA) 719 Vector Space Methods in System Optimization
OR(BMA,ST) 722 Decision Analytic Modeling
OR(IE) 726 Theory of Activity Networks
OR(E,MA) 731 Dynamic Systems and Multivariable Control II
OR(IE) 761 Queues and Stochastic Service Systems
OR(CSC,ECE,IE) 762 Computer Simulation Techniques
OR(IE,MA) 766 Network Flows
OR(IE) 772 Stochastic Simulation Design and Analysis
OR(BMA,MA,ST) 773 Stochastic Modeling
OR(BMA) 774 System Modeling Theory
OR(IE,MA) 790 Advanced Special Topics in Systems Analysis and Optimization
OR 791 Advanced Special Topics
OR 801 Seminar
OR 810 Special Topics
OR(IE,MA) 812 Special Topics in Mathematical Programming
OR 815 Advanced Special Topics
OR(IE,MA) 816 Advanced Special Topics in System Optimization
OR 852 Practicum in Operations Research
OR(IE) 862 Scheduling and Routing
OR 885 Doctoral Supervised Teaching
OR 890 Doctoral Preliminary Examination
OR 893 Doctoral Supervised Research
OR 895 Doctoral Dissertation Research
OR 896 Summer Dissertation Research
OR 899 Doctoral Dissertation Preparation

SUGGESTED COGNATE COURSES

Cognate courses are courses that are often included in OR programs of study, but which carry other departmental designations. They cover subject matter closely related to OR and provide additional insight into the theory or application of OR methodology. Students may include cognate courses in their programs of study with the consent of their faculty advisor.

BMA(MA,ST) 771, 772 Biomathematics I, II
CSC 505 Design and Analysis of Algorithms
CSC(MA) 580 Numerical Analysis I
CSC(ECE) 779 Advanced Computer Performance Modeling
CSC(MA) 780 Numerical Analysis II
ECE 521 Digital Computer Technology and Design
ECG 750 Economic Decision Theory
ECG(ST) 751 Econometrics
ECG(ST) 752 Topics in Econometrics
IE 723 Production Planning, Scheduling and Inventory Control
IE 747 Reliability Engineering
IE 748 Quality Engineering
MA 523 Linear Transformations and Matrix Theory
MA(ST) 546 Theory of Probability
MA 715 Functional Analysis I
MA 723 Theory of Matrices and Applications
MA(ST) 746 Introduction to Stochastic Processes
MA(ST) 778, 779 Measure Theory and Advanced Probability
MA 798 Special Topics in Numerical Analysis
ST 730 Applied Time Series Analysis
ST 782, 783 Time Series Analysis I, II
ST 785 Introduction to Statistical Decision Theory

NCSU Graduate Catalog

Parks, Recreation and Tourism Management

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Parks, Recreation, and Tourism Management	Y		Y		Y		

GRADUATE FACULTY

J. D. Wellman, ***Department Head***

Director of Graduate Programs:
J. C. Peel, Box 8004, 515.3663, judy_peel@ncsu.edu, Parks, Recreation & Tourism Mgmt.

Professors: H. A. Devine, M. F. Floyd, K. A. Henderson, J. C. Peel, C. D. Siderelis, J. D. Wellman; ***Professors Emeriti:*** P. S. Rea, M. R. Warren Jr.; ***Associate Professors:*** A. Attarian, G. L. Brothers, C. Goode, L. D. Gustke, M. A. Kanters, Y. Leung, R. L. Moore; ***Research Associate Professors:*** P. K. Baran; ***Associate Professors Emeriti:*** C. S. Love; ***Assistant Professors:*** J. Bocarro, J. Casper, H. Grappendorf, M. G. Harrolle, E. Lindsay, R. W. Wade; ***Adjunct Assistant Professors:*** J. Fels

The Master's degree provides students the opportunity to develop and enhance their critical understanding of both the conceptual foundations of parks, recreation and tourism management and the procedures of systematic inquiry and critical problem solving as applied to planning and management issues. The department offers educational opportunities and resources for the preparation of professionals concerned with planning, organizing, managing and directing parks, recreation, sport, and tourism programs, areas, and facilities. The general emphasis areas at the Master's level include: parks and recreation management, tourism development and management, geographic information systems, recreational sport management, and natural resource recreation management.

The doctoral students' programs of study are tailored to match their particular experiences and aspirations, and all doctoral programs will concentrate on one of four areas. All include a specialty area of park and recreation management, tourism management, spatial information systems, or sports management.

Master's Degree Requirements: The M.S. degree requires 30 credit hours, of which six hours is Master's thesis research. The M.P.R.T.M. requires a minimum of 36 hours of course work, of which four hours is a Master's project. A minor is optional with the M.S. degree. The department offers a dual Master's option with Public Administration which includes 48 hours of course work. A Master of Natural Resources degree is also available. Master's application deadline is April 15 for U.S. students; March 1 for international students. This program has fall admission *only*; there are no spring admissions.

Doctoral Degree Requirements: Although each doctoral course of study will be unique to the individual student, the usual course of study will include a minimum of 54 hours beyond the Master's. These credit hours are distributed among the core courses, statistics and research methods, a minor or substantive area consisting of 15 hours of course work approved by the student's faculty advisor, and the dissertation. Students will be expected to have completed a Master's degree, preferably one with a thesis. Students not possessing a Master's will have to demonstrate their ability to do graduate work prior to admission into the Ph.D. program. Students without research experience will have to demonstrate an ability to produce scholarly work in PRTM. Doctoral application deadline is March 15 for U.S. students, March 1 for international students. This program has fall admission *only*; there are no spring admissions.

Student Financial Support: Graduate assistantships and internships are available to students in this program on a competitive basis.

GRADUATE COURSES

PRT 500 Theories of Leisure and Recreation
PRT 501 Research Methods in Recreation
PRT(ECG) 503 Economics of Recreation
PRT 504 Recreation and Park Data Systems
PRT 505 Quantitative Techniques for Recreation and Natural Resource Management
PRT 507 Services, Facilities and Event Marketing
PRT 510 Theories of Sport and Fitness Program Management
PRT 511 Foundations for Sport, Exercise and Fitness Program Management
PRT 512 Recreational Sport Management
PRT 520 Concepts of Travel and Tourism
PRT (NR) 531 Intro. Geographic Information Science
PRT (NR) 532 Principles of Geographic Information Science
PRT (NR) 533 App. Issues Geographic Information Science
PRT(NR) 535 Computer Cartography
PRT 550 Outdoor Recreation Behavior
PRT 555 Environmental Impacts of Recreation and Tourism
PRT 580 Current Issues in Recreation Resources
PRT 601 Seminar
PRT 602 Recreation Management Seminar I
PRT 603 Recreation Management Seminar II
PRT 610 Special Topics
PRT 620 Special Problems
PRT 625 Advanced Problems
PRT 660 Field Studies in Recreation
PRT 685 Master's Supervised Teaching
PRT 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PRT 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PRT 690 Master's Examination
PRT 693 Master's Supervised Research
PRT 695 Master's Thesis Research
PRT 696 Summer Thesis Research
PRT 699 Master's Thesis Preparation
PRT 700 Advanced Theories of Leisure
PRT 763 Application Issues in Geographic Information Systems
PRT 764 Advanced Study in Geographic Information Systems
PRT 795 Special Topics in Recreation Resources
PRT 801 Seminar
PRT 820 Special Problems
PRT 885 Doctoral Supervised Teaching
PRT 890 Doctoral Preliminary Examination
PRT 893 Doctoral Supervised Research
PRT 895 Doctoral Dissertation Research
PRT 896 Summer Dissertation Research
PRT 899 Doctoral Dissertation Preparation

Physics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Physics	Y		Y				

GRADUATE FACULTY

M. A. Paesler, ***Department Head***

Director of Graduate Programs:
H. Ade, Box 8202, 515.8706, harald_ade@ncsu.edu, Physics

Distinguished Educator in Residence: B. Sherwood
Distinguished University Professor of Physics: D. E. Aspnes
Graduate Alumni Distinguished Professor: G. E. Mitchell
University Professor: G. Lucovsky

Professors: H. Ade, R. J. Beichner, J. Bernholc, J. M. Blondin, R. W. Chabay, S. R. Cotanch, D. C. Ellison, R. E. Fornes, C. R. Gould, D. G. Haase, H. Hallen, C. R. Ji, J. Krim, L. Mitas, J. R. Mowat, R. Nemanich, M. A. Paesler, S. P. Reynolds, J. S. Risley, C. M. Roland, T. Schaefer, A. R. Young; ***Research Professors:*** R. Golub, J. E. Rowe, J. F. Schetzina; ***Visiting Professors:*** J. L. Hubisz; ***Adjunct Professors:*** B. Fortner, C. R. Philbrick; ***Professors Emeriti:*** K. T. Chung, W. R. Davis, W. O. Doggett, G. L. Hall, A. W. Jenkins Jr., K. L. Johnston, G. H. Katzin, F. Lado Jr., J. D. Memory, R. R. Patty, L. W. Seagondollar, P. J. Stiles, D. R. Tilley; ***Associate Professors:*** J. D. Brown, M. Buongiorno-Nardelli, P. Huffman, M. A. Klenin, G. McLaughlin, M. C. Sagui; ***Research Associate Professors:*** K. J. Borkowski; ***Adjunct Associate Professors:*** P. E. Garrett; ***Associate Professors Emeriti:*** G. W. Parker III; ***Assistant Professors:*** L. I. Clarke, K. Daniels, D. J. Lee, T. P. Pearl, R. Riehn, K. R. Weninger; ***Research Assistant Professors:*** J. Bochinski, J. H. Kelley, W. Lu

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: J. Narayan, R. M. Kolbas; ***Professors Emeriti:*** J. M. Danby, D. L. Ridgeway; ***Associate Professors:*** L. K. Norris, J. C. Park

Theoretical/computational research opportunities are available in the following areas: astrophysics and relativity, nanoscience/materials and biomolecular simulations, and nuclear/particle physics. Experimental research opportunities are available in the following areas: astronomy, biophysics and soft-condensed matter physics, emergent phenomena and non-linear systems, nuclear physics, optics, physics education, materials physics and nanoscale science and technology, and synchrotron radiation research.

Admission Requirements: Bachelor's degree in physics (or the equivalent) and the GRE Advanced test in physics.

Master's Degree Requirements: A minimum of 30 credit hours beyond the Bachelor's degree; demonstrated mastery of aspects of the physics curriculum: PY 781, 782. Thesis and non-thesis options.

Doctoral Degree Requirements: Seventy-two (72) credit hours beyond the Bachelor's degree; demonstrated mastery of core physics curriculum: PY 721, 781, 782, 783, 785, 786.

Student Financial Support: Graduate teaching assistantships are available for new and continuing students; research assistantships are normally available only to continuing students.

GRADUATE COURSES

PY 501 Quantum Physics I
PY 502 Quantum Physics II
PY 506 Nuclear and Subatomic Physics
PY 507 Elementary Particle Physics
PY 508 Ion and Electron Physics
PY 509 Plasma Physics
PY 511 Mechanics I
PY 512 Mechanics II
PY 514 Electromagnetism I
PY 515 Electromagnetism II
PY 516 Physical Optics
PY 517 Atomic and Molecular Physics
PY 525 Computational Physics
PY(NE) 528 Introduction to Plasma Physics and Fusion Energy
PY 543 Astrophysics
PY 552 Introduction to the Structure of Solids
PY 561 Electronics for Physicists
PY(MA) 575 Mathematical Introduction to Celestial Mechanics
PY(MA) 576 Orbital Mechanics
PY 601 Seminar
PY 610 Special Topics
PY 615 Advanced Special Topics
PY 660 Advanced Placement Physics for Secondary School Teachers
PY 685 Master's Supervised Teaching
PY 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PY 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PY 693 Master's Supervised Research
PY 695 Master's Thesis Research
PY 696 Summer Thesis Research
PY 699 Master's Thesis Preparation
PY 711 Advanced Quantum Mechanics I
PY 712 Advanced Quantum Mechanics II
PY 721 Statistical Physics I
PY 722 Statistical Physics II
PY(ECE) 727 Semiconductor Thin Films Technology
PY 730 Nuclear Structure Physics I
PY 753 Introduction to the Structure of Solids II
PY 754 Properties of Surfaces and Interfaces
PY 755 Dielectric Films and their Interfaces
PY 781 Quantum Mechanics I
PY 782 Quantum Mechanics II
PY 783 Advanced Classical Mechanics I
PY 785 Advanced Electricity and Magnetism I
PY 786 Advanced Electricity and Magnetism II
PY 801 Seminar
PY 810 Special Topics
PY 815 Advanced Special Topics
PY 860 Advanced Placement Physics for Secondary School Teachers
PY 885 Doctoral Supervised Teaching
PY 890 Doctoral Preliminary Examination
PY 893 Doctoral Supervised Research
PY 895 Doctoral Dissertation Research
PY 896 Summer Dissertation Research
PY 899 Doctoral Dissertation Preparation

Physiology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Physiology	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
M. C. Roberts, Box 8401, 513.6248, malcolm_roberts@ncsu.edu, Physiology

William Neal Reynolds Distinguished Professor and Director of Graduate Programs ANP and PSC: J. T. Brake
William Neal Reynolds Professor of Entomology and Toxicology: R. M. Roe

Professors: G. W. Almond, B. P. Alston-Mills, K. E. Anderson, B. L. Black, V. L. Christensen, W. J. Croom Jr., F. W. Edens, K. L. Esbenshade, C. E. Farin, W. L. Flowers, R. M. Grossfeld, H. F. Heatwole, T. E. LeVere, N. C. Olson, S. L. Pardue, J. N. Petitte, R. M. Petters, M. C. Roberts, T. D. Siopes, C. V. Sullivan, H. A. Underwood Jr., S. P. Washburn, T. G. Wolcott; ***Professors Emeriti:*** C. H. Hill, J. F. Roberts; ***Associate Professors:*** A. T. Blikslager, R. J. Borski, B. A. Breuhaus, P. W. Farin, J. E. Gadsby, P. E. Mozdziak, M. Schramme, C. S. Whisnant, M. D. Whitacre; ***Assistant Professors:*** J. Gookin, B. J. Grubb, M. E. Hockett, J. L. Lubischer, C. R. F. Pinto, G. Smith; ***Research Assistant Professors:*** T. Ghashghaei

ASSOCIATE MEMBERS OF THE PROGRAM

Assistant Professors: M. Koci

The physiology faculty is an interdepartmental and intercollege group drawn from the departments of animal science, biochemistry, clinical sciences, entomology, molecular and biomedical sciences, population health and pathobiology, poultry science, psychology, and zoology. The program emphasizes a broad and interdisciplinary approach and is designed to prepare individuals for careers in research and teaching. Experimental animals used in research include insects and other invertebrates, avian and aquatic species, companion and food producing animals.

Admission Requirements: Students entering the graduate program in physiology should have a Bachelor's degree in a related biological or physical science. Undergraduate courses should include physiology, biochemistry, organic chemistry, calculus, and physics. Each application package will be screened by the Admissions Committee. Factors considered for admission include: grade point average (3.0 is required for regular admission), GRE scores, undergraduate courses, letters of recommendation, and the willingness of a member of the Graduate Physiology faculty to serve as the applicant's advisor. Some prior research experience is highly recommended.

Master's Degree Requirements: All Master's students are required to complete PHY 503, PHY 504, BCH 553, and a course in research ethics. *Master of Science Degree:* For a Master of Science degree a minimum of 30 semester hours of graduate work in the degree program is required including a minimum of 20 hours of course work at the 500-800 level. On average, the M.S. degree requires two to three years. *Master of Physiology Degree:* The non-thesis Master's degree (Master of Physiology) requires a total of 36 credits. On average, the MOP degree requires two years to complete.

Doctoral Degree Requirements: A doctoral degree requires a minimum of 72 graduate credit hours beyond the Bachelor's degree in accordance with the requirements of the Graduate School. All Ph.D. students are required

to complete PHY 503, PHY 504, BCH 553, PHY 801, one additional course in biochemistry or an alternative 800-level course, and a course in research ethics. On average, completion of the Ph.D. degree requires five years.

Student Financial Support: Financial assistance for qualified students in the form of research assistantships, fellowships and traineeships is available through participating departments only and not through the physiology program. Stipends will be offered to qualified applicants admitted in the College of Veterinary Medicine. There is no financial support for students in the Master of Physiology program.

Other Relevant Information: The physiology program is jointly administered by the College of Agriculture and Life Sciences and the College of Veterinary Medicine. Graduate students enrolled as physiology majors are housed in the department of their major professor and may participate in departmental activities.

GRADUATE COURSES

PHY(ZO) 503 General Physiology I
PHY(ZO) 504 General Physiology II
PHY(ZO) 513 Comparative Physiology
PHY(PO,ZO) 524 Comparative Endocrinology
PHY 595 Special Topics in Physiology
PHY 601 Seminar
PHY(ZO) 602 Seminar in Biology of Reproduction
PHY 610 Special Topics
PHY 620 Special Problems
PHY 685 Master's Supervised Teaching
PHY 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PHY 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PHY 690 Master's Examination
PHY 693 Master's Supervised Research
PHY 695 Master's Thesis Research
PHY 696 Summer Thesis Research
PHY 699 Master's Thesis Preparation
PHY(ANS) 702 Reproductive Physiology of Mammals
PHY(CBS,IMM) 756 Immunogenetics
PHY(ANS,CBS,NTR) 764 Advances in Gastrointestinal Pathophysiology
PHY(ANS) 780 Mammalian Endocrinology
PHY 801 Seminar
PHY(ANS,CBS,ZO) 802 Seminar in Biology of Reproduction
PHY 810 Special Topics
PHY 820 Special Problems
PHY 885 Doctoral Supervised Teaching
PHY 890 Doctoral Preliminary Examination
PHY 893 Doctoral Supervised Research
PHY 895 Doctoral Dissertation Research
PHY 896 Summer Dissertation Research
PHY 899 Doctoral Dissertation Preparation

OTHER SUPPORTING COURSES AVAILABLE

Other supporting courses are available in animal science, biochemistry, biomathematics, biotechnology, cell biology, comparative biomedical sciences, entomology, genetics, immunology, microbiology, nutrition, pharmacology, poultry science, psychology, statistics, toxicology and zoology. Certain courses on the interface between physiology and engineering may be taken after consultation with advisor and the instructors concerned.

Plant Biology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Botany	Y		Y		Y		
Plant Biology	Y		Y		Y		

GRADUATE FACULTY

M. E. Daub, ***Department Head***

Director of Graduate Programs:
R. S. Boston, Box 7612, 515.3390, rebecca_boston@ncsu.edu, Botany

Distinguished University Professor: W. F. Thompson
William Neal Reynolds Distinguished Professor: W. F. Boss
William Neal Reynolds Professor: R. S. Boston

Professors: N. S. Allen, R. L. Blanton, J. M. Burkholder, M. E. Daub, C. H. Haigler, T. L. Lomax, J. B. Ristaino, D. Robertson, T. W. Rufty Jr., E. C. Sisler, J. F. Thomas, C. G. Van Dyke, T. R. Wentworth; ***Research Professors:*** C. S. Brown; ***Professors Emeriti:*** U. Blum, E. Davies, R. J. Downs, R. C. Fites, J. W. Hardin, W. W. Heck, R. L. Mott, G. R. Noggle, E. D. Seneca, J. R. Troyer, E. A. Wheeler; ***Associate Professors:*** H. V. Amerson, R. L. Beckmann, S. Hu, J. E. Mickle, J. M. Stucky, R. W. Whetten, Q. Xiang; ***Associate Professors (USDA):*** K. O. Burkey; ***Assistant Professors:*** S. B. Carson, W. A. Hoffmann, C. Jordan, A. Krings, H. I. A. Sederoff, D. Xie; ***Research Assistant Professors:*** I. Y. Perera

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: J. B. Ristaino, T. W. Rufty, Jr., E. C. Sisler; ***Professors Emeriti:*** E. A. Wheeler; ***Associate Professors:*** H. V. Amerson, S. Hu, R. W. Whetten; ***Associate Professors (USDA):*** K. O. Burkey

Course offerings or research facilities are available in the following areas: plant cell biology, cellular imaging, membrane biochemistry, seed biology, cellulose biology, cellular signaling, plant development, plant genetic engineering, transgene regulation and silencing, wound responses, stress biology, plant gravitational genomics, phytochemistry, metabolic engineering, plant fungal interactions, aquatic ecology, toxic dinoflagellates, wetlands ecology, endangered species, plant community ecology, physiological ecology, tropical ecology, paleobotany, plant systematics, evolution of flowering plants.

Admission Requirements: In special situations, students with an undergraduate GPA of less than 3.00 (on a 4.00 scale) may be admitted provisionally. If students lack certain prerequisites (e.g., in mathematical, chemical, biological or other areas), additional courses may be required that do not qualify for graduate credit. The best qualified students will be accepted when spaces are available for new students.

Master's and Doctoral Degree Requirements: The M.S. requires a total of 30 credit hours (20 of the 30 credit hours must be from 500-, 600-, 700/800-level courses); the Master of Plant Biology requires a total of 36 credit hours. The Ph.D. requires a total of 72 credit hours. Two core courses (Plant Form and Function and Plant Functional Ecology) are required. Other requirements include: a Plant Biology Colloquium, an additional plant biology course, a graduate statistics course, a graduate ethics course, a thesis (for the Ph.D. and M.S., but not the Master of Plant Biology), a comprehensive examination (Ph.D.), oral thesis defense and a one-semester teaching responsibility per degree. Students must maintain a "B" average in all course work.

Other Relevant Information: Graduate research and teaching assistantships and tuition remission information are available from the department. Graduate students are expected to attend and participate in the seminar program every semester they are in residence. The department participates in training grants in biotechnology and genomics.

GRADUATE COURSES

PB(MB,PP) 501 Fungi and Their Interaction with Plants
PB 503 Systematic Botany
PB 544 Plant Geography
PB 565 Plant Community Ecology
PB(MB,PP) 575 Introduction to Mycology
PB(BIT) 581 Plant Tissue Culture and Transformation
PB 595 Special Topics
PB 601 Botany Seminar
PB 620 Special Problems in Botany
PB 624 Topical Problems
PB 685 Master's Supervised Teaching
PB 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PB 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PB 690 Master's Examination
PB 693 Master's Supervised Research
PB 695 Master's Thesis Research
PB 696 Summer Thesis Research
PB 699 Master's Thesis Preparation
PB 710 Plant Anatomy
PB(CS,HS) 718 Biological Control of Weeds
PB(GN,MB,PP) 730 Fungal Genetics and Physiology
PB 733 Plant Growth and Development
PB 745 Paleobotany
PB 751 Advanced Plant Physiology I
PB 752 Advanced Plant Physiology II
PB 754 Laboratory in Advanced Plant Physiology II
PB(ZO) 760 Principles of Ecology
PB 761 Physiological Ecology
PB 762 Applied Coastal Ecology
PB(ZO) 770 Advanced Topics in Ecology I
PB(MB) 774 Phycology
PB 775 The Fungi
PB 776 The Fungi Lab
PB 780 Plant Molecular Biology
PB 795 Special Topics
PB 801 Botany Seminar
PB 820 Special Problems
PB 824 Topical Problems
PB 885 Doctoral Supervised Teaching
PB 890 Doctoral Preliminary Examination
PB 893 Doctoral Supervised Research
PB 895 Doctoral Dissertation Research
PB 896 Summer Dissertation Research
PB 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Plant Pathology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Plant Pathology	Y		Y		Y		

GRADUATE FACULTY

J. W. Moyer, ***Department Head***

Director of Graduate Programs:
D. F. Ritchie, Box 7616, 515.6809, david_ritchie@ncsu.edu, Plant Pathology

Philip Morris Professor: T. A. Melton, III
Philip Morris Professor Emeritus: P. B. Shoemaker
William Neal Reynolds Professor: R. A. Dean, G. A. Payne

Professors: D. M. Benson, D. M. Bird, R. I. Bruck, M. E. Daub, E. L. Davis, L. F. Grand, S. Leath, S. A. Lommel, J. W. Moyer, C. H. Opperman, J. B. Ristaino, D. F. Ritchie, R. C. Rufty, H. D. Shew, T. B. Sutton, C. G. Van Dyke; ***Professors (USDA):*** D. S. Marshall; ***Visiting Professors:*** C. S. Hodges Jr.; ***Professors Emeriti:*** J. L. Apple, C. W. Averre III, R. Aycock, O. W. Barnett Jr., D. F. Bateman, M. K. Beute, G. V. Gooding Jr., J. Huang, R. K. Jones, L. T. Lucas, C. E. Main, R. D. Milholland, N. T. Powell, J. P. Ross, H. W. Spurr Jr., H. H. Triantaphyllou, J. C. Wells, N. N. Winstead; ***Associate Professors:*** M. Cubeta, G. J. Holmes, S. Hu, F. J. Louws; ***Associate Professors (USDA):*** R. G. Upchurch; ***Assistant Professors:*** I. Carbone, K. L. Ivors, A. Mila, L. Tredway, P. Veronese; ***Research Assistant Professors:*** S. R. Koenning, B. B. Shew; ***Assistant Professors (USDA):*** P. J. Balint-Kurti, C. Cowger

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: E. B. Cowling, W. M. Hagler, Jr., C. L. Hemenway

Plant pathology is committed to solving plant disease problems with research that focuses on plant-pathogen interactions at the genomic, cellular, organismal, and ecological levels. Approaches include disease management, epidemiology, molecular biology and host-parasite interactions. Focus areas are bacteriology, bioinfomatics, functional genomics, mycology, nematology, virology, soil-borne pathogens and mechanisms of pathogenesis, and host resistance.

Admission Requirements: The general application procedures of the Graduate School noted at the beginning of this section are followed. Applicants are required to submit GRE results. A detailed statement of applicant interests and goals in plant pathology is most useful to the admissions committee.

Master's Degree Requirements: There is a core curriculum of a minimum of 12 credit hours that includes PP 501, PP 502, PP 506, PP 707, and PP 601. The core should be supplemented with a minimum of 18 credit hours in courses at the 500 or higher level, which support the focus of the study. Students serve as teaching assistants for one course.

Doctoral Degree Requirements: Students entering the Ph.D. degree program are expected to take the core curriculum outlined for the Master's degree or have had the equivalent at another institution. Additionally, Ph.D. students must include a departmental-approved ethics course, two credits PP 801, and at least two other 700-level Plant Pathology courses. Ph.D. students serve as teaching assistants for two courses.

Student Financial Support: A limited number of half-time assistantships are available on a competitive basis. Benefits include in-state tuition, out-of-state tuition and health insurance as covered under the Graduate School's Graduate Student Support Plan. Applicants are considered for assistantship support at time of application. Special supplements to assistantships are available on a competitive basis for outstanding students. Also, many faculty programs have research grant-funded or training grant-funded assistantships.

Other Relevant Information: Fully equipped and staffed laboratories for research are available in addition to greenhouse facilities and environmental growth chambers in the phytotron. Special facilities for experimental work on diseases under field conditions are available at 16 University-related locations throughout the state. Genomics facilities, microcomputers, library, mycological herbarium, digital imaging/graphics equipment programs, and an interdepartmental electron microscopy center are additional features available for the department.

GRADUATE COURSES

PP 500 Plant Disease: Principles, Diagnosis and Management
PP(PB,MB) 501 Fungi and Their Interaction with Plants
PP(CS,HS) 502 Plant Disease: Methods and Diagnosis
PP 504 Plant Nematology
PP 505 Introductory Plant Virology
PP 506 Epidemiology and Plant Disease Control
PP 507 Plant Microbe Interactions
PP 530 Agriculture, Ethics and the Environment
PP(PB,MB) 575 Introduction to Mycology
PP 590 Special Topics
PP 601 Seminar
PP 610 Special Topics
PP 615 Advanced Special Topics
PP 620 Special Problems
PP 685 Master's Supervised Teaching
PP 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PP 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PP 690 Master's Examination
PP 693 Master's Supervised Research
PP 695 Master's Thesis Research
PP 696 Summer Thesis Research
PP 699 Master's Thesis Preparation
PP 707 Plant Microbe Interactions
PP 725 Molecular Biology of Plant Viruses
PP 728 Soilborne Plant Pathogens
PP(PB,GN,MB) 730 Fungal Genetics and Physiology
PP(CS,GN,HS) 748 Breeding for Pest Resistance
PP 790 Special Topics
PP 795 Advanced Special Topics
PP 801 Seminar
PP 810 Special Topics
PP 815 Advanced Special Topics
PP 820 Special Problems
PP 885 Doctoral Supervised Teaching
PP 890 Doctoral Preliminary Examination
PP 893 Doctoral Supervised Research
PP 895 Doctoral Dissertation Research
PP 896 Summer Dissertation Research
PP 899 Doctoral Dissertation Preparation

Poultry Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Poultry Science			Y		Y		

GRADUATE FACULTY

S. L. Pardue, ***Department Head***

Director of Graduate Programs:
J. T. Brake, Box 7608, 515.5060, jbrake@ncsu.edu, Poultry Science

William Neal Reynolds Distinguished Professor and Director of Graduate Programs ANP and PSC: J. T. Brake

Professors: K. E. Anderson, V. L. Christensen, W. J. Croom Jr., F. W. Edens, P. R. Ferket, J. L. Grimes, W. M. Hagler Jr., G. B. Havenstein, J. F. Ort, S. L. Pardue, C. R. Parkhurst, J. N. Petitte, B. W. Sheldon, J. C. H. Shih, T. D. Siopes, C. M. Williams, M. J. Wineland; ***Adjunct Professors:*** W. L. Bryden, M. Choct, K. K. Krueger, B. Roush, S. M. Shane, Z. Uni; ***Professors Emeriti:*** T. A. Carter, W. E. Donaldson, J. D. Garlich, E. W. Glazener, P. B. Hamilton, J. R. Harris, C. H. Hill; ***Associate Professors:*** D. K. Carver, P. E. Mozdziak, P. D. Siciliano; ***Adjunct Associate Professors:*** C. E. Whitfill; ***Assistant Professors:*** C. M. Ashwell, M. Koci, E. Oviedo-Rondon, S. E. Pratt, C. R. Stark; ***Adjunct Assistant Professors:*** D. S. Casey, J. V. Felts, A. Gernat, C. L. Heggen-Peay, R. O. Maguire, T. F. Middleton, C. J. Williams

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: D. P. Wages

Course offerings and research programs are comprehensive in the areas of physiology, nutrition, microbiology, molecular biology, biotechnology, food science, immunology, genetics, pathology, and toxicology. The demand for men and women with advanced training in poultry science is far greater than the supply. Opportunities exist for graduates in research and teaching in universities, government, and private industry.

Admission Requirements: Factors considered for admission include grade point average, strength of prior academic program, experience, letters of recommendation, and special skills or interests. GRE scores are required.

Master's Degree Requirements: While there are no specific course requirements for the master's degree in poultry science, most programs exceed the minimum 30 credit hours.

Doctoral Degree Requirements: See Animal Science and Poultry Science.

Student Financial Support: Both research and teaching assistantships are available on a competitive basis within the department. General requirements for these assistantships are as described in the Graduate Catalog. Other financial support may be available in the form of graduate stipend supplementation, research grant support, or out-of-state tuition waivers in accordance with the University's Graduate Student Support Plan.

Other Relevant Information: The Department of Poultry Science occupies modern facilities in Scott Hall, a three-story building on the main campus adjacent to the D.H. Hill Library. The department consists of about 22 faculty, approximately 50 support staff, 25-35 graduate students and postdoctoral associates, and 60-80

undergraduate students.

For more information, visit the Department of Poultry Science website.

GRADUATE COURSES

PO 505 Physiological Aspects of Poultry Management
PO 524 Comparative Endocrinology
PO(BIT) 566 Animal Cell Culture Techniques
PO 590 Special Problems in Poultry Science
PO 601 Seminar
PO 620 Special Problems
PO 685 Master's Supervised Teaching
PO 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PO 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PO 693 Master's Supervised Research
PO 695 Master's Thesis Research
PO 696 Summer Thesis Research
PO 699 Master's Thesis Preparation
PO 702 Biotechniques in Avian Biology
PO(CBS,IMM,PHY) 756 Immunogenetics
PO(IMM) 757 Avian Immunology
PO(ANS,NTR) 775 Mineral Metabolism
PO 801 Seminar
PO 820 Special Problems
PO 885 Doctoral Supervised Teaching
PO 893 Doctoral Supervised Research
PO 895 Doctoral Dissertation Research
PO 896 Summer Dissertation Research
PO 899 Doctoral Dissertation Preparation

Psychology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Psychology	Y		Y				

GRADUATE FACULTY

D. Gillan, ***Department Head***

Director of Graduate Programs:
D. H. Mershon, Box 7650, 515.1724, psych@ncsu.edu, Psychology

Professors: L. E. Baker-Ward, J. P. Braden, K. B. DeBord, D. W. Drewes, W. P. Erchul, D. Gillan, D. O. Gray, A. G. Halberstadt, T. M. Hess, J. W. Kalat, T. E. LeVere, D. W. Martin, D. H. Mershon, J. J. Michael, R. W. Nacoste, F. J. Smith; ***Adjunct Professors:*** A. D. Hall, W. E. Schlenger, L. G. Tornatzky; ***Professors Emeriti:*** J. W. Cunningham, J. E. R. Luginbuhl, H. G. Miller, S. E. Newman, P. W. Thayer; ***Associate Professors:*** C. C. Brookins, M. E. Haskett, K. W. Klein, S. A. Lane, S. B. Pond III, A. C. Schulte, S. S. Snyder, M. A. Wilson, M. S. Wogalter, M. B. Wyer; ***Adjunct Associate Professors:*** B. H. Beith, M. G. Sanders, W. M. Wechsberg; ***Associate Professors Emeriti:*** J. L. Cole; ***Assistant Professors:*** J. C. Allaire, J. C. Begeny, P. W. Collins, S. B. Craig, P. P. Martin, C. B. Mayhorn, A. C. McLaughlin, A. W. Meade, R. E. Mitchell, S. D. Neupert, L. F. Thompson; ***Adjunct Assistant Professors:*** J. W. Fleenor, D. J. Holden, C. L. Kronberg

ASSOCIATE MEMBERS OF THE PROGRAM

Associate Professors: B. S. Mehlenbacher, E. N. Wiebe

The Department of Psychology offers five courses of study leading to the Ph.D.: developmental psychology, ergonomics and experimental psychology, psychology in the public interest, industrial/organizational psychology, and school psychology.

Admission Requirements: Applicants should have satisfactory grades in all undergraduate work and at least a "B" average in undergraduate psychology courses, satisfactory scores on the GRE and three satisfactory letters of recommendation. The GRE subject test is no longer required, but is strongly encouraged, especially for non-psychology majors. Faculty will examine transcripts for evidence of basic psychology competence. Match of applicants' research interests with current faculty research is usually an important consideration.

Master's Degree Requirements: Specific course requirements vary by area. Typical programs will include from 36 to 55 hours. The M.S. degree is available as part of work toward the doctorate, but students wishing to obtain a terminal M.S. are advised to consider other programs.

Doctoral Degree Requirements: The graduate program for each doctoral student is determined in conjunction with the student's graduate advisory committee and tailored to the needs, interests, and accomplishments of the individual. Students can expect to take from 36 to 54 hours of credit beyond the master's degree.

Student Financial Support: Many graduate students receive financial support in the form of teaching or research assistantships. Applicants should request such support when they apply to the program.

GRADUATE COURSES

PSY 500 Visual Perception

PSY 502 Physiological Psychology
PSY(WGS) 506 Psychology of Gender
PSY 508 Cognitive Processes
PSY 510 Advanced Problems in Psychology
PSY 511 Advanced Social Psychology
PSY 513 Psychology and Law
PSY(PHI) 525 Introduction to Cognitive Science
PSY 535 Tests and Measurements
PSY(IE) 540 Human Factors in Systems Design
PSY 553 Principles and Practice of Ecological/community Psychology
PSY 558 Psychology and the African Experience
PSY(EDP) 582 Adolescent Development
PSY 584 Advanced Developmental Psychology
PSY 591 History and Systems of Psychology
PSY 620 Special Problems in Psychology
PSY 641 Psychological Clinic Practicum
PSY 651 Internship in Psychology
PSY 680 Directed Study in Psychology
PSY 685 Master's Supervised Teaching
PSY 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PSY 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PSY 693 Master's Supervised Research
PSY 695 Master's Thesis Research
PSY 696 Summer Thesis Research
PSY 699 Master's Thesis Preparation
PSY 700 Audition and Other Non-visual Senses
PSY 703 Biological Factors in Abnormal Behavior
PSY 704 Learning and Motivation
PSY 710 Special Topics in Psychology
PSY 712 Attitudes
PSY 713 Attribution
PSY 714 Social Psychology: Small Groups Research
PSY 720 Psychological Survey Operations
PSY 721 Area Seminar in School Psychology
PSY 722 Individual Intelligence Measurement
PSY 723 Personality Measurement
PSY 724 Psychological Intervention I
PSY 725 Psychological Intervention II
PSY 727 Psychological Consultation
PSY 732 Theories of Intelligence
PSY(IE) 740 Engineering Psychology of Human-Computer Interaction
PSY(IE) 743 Ergonomic Performance Assessment
PSY(IE) 744 Human Information Processing
PSY(IE) 745 Human Performance Modeling
PSY 750 Area Seminar in Human Resources Development
PSY 751 Human Resource Planning
PSY 752 Action Research in Psychology
PSY 755 Cross-cultural Research and Development
PSY 756 Consumer Research
PSY 757 Innovation and Technology: A Socio-technical Perspective
PSY 760 Psychometrics
PSY 761 Advanced Psychometrics: Item Response Theory
PSY 762 Quasi-experimental Evaluation Design
PSY 763 Systems Theory and Applications in Human Resource Development
PSY 764 Survey of Industrial/Organizational Psychology
PSY 765 Vocational Psychology
PSY 766 Personnel Selection Research
PSY 767 Training Research
PSY 768 Organizational Psychology
PSY 769 Work Motivation
PSY 770 Organization Development and Change
PSY 785 Methodological Issues in Developmental Psychology
PSY 786 Cognitive Development
PSY 787 Social Development
PSY 788 Adulthood and Aging: Cognitive and Intellectual Change

PSY 789 Socio-emotional Processes in Adulthood and Aging
PSY 792 Psychology of Families and Parenting
PSY 795 Stress and Coping
PSY 800 Introduction to Graduate Study in Psychology
PSY(IE) 802 Area Seminar in Ergonomics
PSY 807 Advanced Seminar in Research Design
PSY 809 Psychology Colloquium
PSY 820 Special Problems in Psychology
PSY 825 Advanced Problems in Perception
PSY 826 Advanced Problems in Cognition
PSY 841 School Psychology Practicum
PSY 846 Practicum in Industrial/Organizational Psychology
PSY 851 Internship in Psychology
PSY 880 Directed Study in Psychology
PSY 885 Doctoral Supervised Teaching
PSY 890 Doctoral Preliminary Examination
PSY 893 Doctoral Supervised Research
PSY 895 Doctoral Dissertation Research
PSY 896 Summer Dissertation Research
PSY 899 Doctoral Dissertation Preparation

Public Administration

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Public Administration	Y				Y		

GRADUATE FACULTY

Director of Graduate Programs:
J. D. Coggburn, Box 8102, 515.1888, jcoggburn@ncsu.edu, Political Science & Public Administration

Professors: C. K. Coe, D. M. Daley, G. D. Garson, R. C. Kearney, D. W. Stewart; ***Associate Professors:*** J. D. Coggburn, E. O'Sullivan, J. E. Swiss, A. J. Taylor, M. L. Vasu; ***Assistant Professors:*** R. Bosworth, J. R. Brunet, R. M. Clerkin, B. Nowell; ***Research Assistant Professors:*** D. L. Weisel; ***Visiting Assistant Professors:*** J. K. Davis, S. K. Straus

Administrative specialties include: association/ non-profit management, information technology, and urban/local government management. Specialized courses are offered in environmental policy, financial management, and human resource management. The only doctoral program in public administration in N.C., the Ph.D. prepares students for teaching and research positions in public management and related fields. The program offers a graduate certificate in non-profit management, which may be included as part of the M.P.A., another graduate degree program, or taken independently.

Admission Requirements: Applicants to the M.P.A. should submit all materials by May 15 (for fall admission) and by November 1 (for spring admission). Completed applications received by February 1 will receive consideration for all available university and department scholarships and assistantships. Admission to the doctoral program normally requires the completion of the M.P.A. or other relevant graduate degree. Ph.D. students are only admitted for the Fall semester. The Ph.D. application deadline is March 15. Applicants are encouraged to submit all materials as soon as possible to assure consideration for fellowships and assistantships.

Master's Degree Requirements: The M.P.A. degree is a 40-semester-hour program consisting of: (1) a core curriculum of 18 credit hours; (2) a choice of administrative specialties, or an individualized program, drawing on courses in public administration and other departments; and (3) an internship or field experience requirement for pre-service students. It is an option B with a one-person committee and no final oral examination. Students who do not have at least two American government courses, a micro-economics course, and an intermediate-level statistics course must successfully complete equivalent coursework prior to graduation.

Doctoral Degree Requirements: The Ph.D. prerequisites are a graduate course in statistics, a course in methodology (covering research design, internal and external validity, sampling, and measurement), and at least two courses in American government or public policy. Students are required to complete M.P.A. core courses in (a) budgeting or management systems, and (b) policy analysis or micro-economics unless they have equivalent courses from other institutions. Fifty-four hours beyond the Master's degree including research seminars (including PA 761, PA 762, PA 763, PA 803), four courses in methodology/statistics (including PA 715, PA 765), and dissertation research are required.

Student Financial Support: A limited number of fellowships and graduate assistantships are offered by the department. Contact the department for more information. Other forms of student aid are described in the financial aid section of the Graduate Catalog.

GRADUATE COURSES

PA 501 Effective Writing for Public Managers

PA 508 Government and Public Administration
PA 509 Applied Political Economy
PA 510 Ethics and Professional Practice
PA 511 Public Policy Analysis
PA 512 The Budgetary Process
PA 513 Seminar in Organization Theory
PA 514 Management Systems
PA 515 Research Methods and Analysis
PA 520 Seminar in Urban Management
PA 521 Government and Planning
PA 522 Intergovernmental Relations in the United States
PA 523 Municipal Law
PA 525 Organization Design
PA 530 Financial Management in the Public Sector
PA 531 Human Resources Management in Public and Nonprofit Organizations
PA 532 Contract Negotiation and Mediation in the Public and Nonprofit Sectors
PA 535 Problem Solving for Public and Nonprofit Managers
PA 536 Management of Non-profit Organizations
PA 537 Association Management
PA 538 Nonprofit Budgeting and Financial Management
PA 539 Fund Development
PA 540 Computer Applications in Public Affairs
PA 541 Geographic Information Systems for Public Administration
PA 542 Public Information Technology
PA 543 E-Government
PA 545 Administrative Law
PA 546 Seminar in Program Evaluation
PA 550 Environmental Policy
PA 555 Administration of Justice
PA 598 Special Topics
PA 601 Effective Public Communications
PA 602 Oral Presentation for Public Managers
PA 610 Special Topics
PA 635 Readings and Research
PA 640 Grantwriting
PA 650 Internship in Public Affairs
PA 651 Advanced Practical Training
PA 652 Public Organization Theory
PA 660 Public Management Computing Lab
PA 685 Master's Supervised Teaching
PA 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
PA 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
PA 701 Politics and Ethics of Public Administration
PA 715 Quantitative Policy Analysis
PA 761 Foundations of Public Administration
PA 762 Public Organization Theory
PA 763 Public Policy Process
PA 764 Budgeting and Financial Management
PA 765 Quantitative Research in Public Administration
PA 770 Contemporary Public Management
PA 780 Independent Study
PA 803 Advanced Research Design
PA 810 Special Topics
PA 835 Readings and Research
PA 851 Internship in Public Affairs
PA 860 Public Management Computing Lab
PA 880 Directed Study
PA 885 Doctoral Supervised Teaching
PA 890 Doctoral Preliminary Examination
PA 893 Doctoral Supervised Research
PA 895 Doctoral Dissertation Research
PA 896 Summer Dissertation Research
PA 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Social Work

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Social Work					Y		

GRADUATE FACULTY

Director of Graduate Programs:
T. U. Hancock, Box 7639, 513.7958, tuhancoc@chass.ncsu.edu, Social Work

Professors: J. T. Pennell; ***Associate Professors:*** T. U. Hancock, C. Waites, L. R. Williams; ***Assistant Professors:*** N. Ames, W. Casstevens, M. T. Leach, K. Osborne, J. D. Taliaferro, J. G. Wells

The mission of the MSW program is to promote a socially responsible society through education, research, and extension/community service. Within a framework emphasizing professional values and ethics, cultural competence, strengths, and partnerships, the MSW program prepares graduate students for advanced practice and leadership roles.

Admission Requirements:

1. Bachelor's degree from an accredited liberal arts college or university
2. Cumulative undergraduate GPA of 3.0 or higher for the last 60 hours of academic work or a GPA of 3.0 or above in previous graduate work; students with a GPA less than 3.0 but greater than 2.5 for the last 60 hours of academic course work must also submit a Graduate Record Exam (GRE) score or a Miller Analogies Test (MAT) score
3. Liberal arts course work in the social sciences, humanities, human biology and statistics
4. Experience in human services (post baccalaureate, paid or volunteer)

Master's Degree Requirements: MSW Students select from two different courses of study: (1) two-year, full-time course of study with courses during the fall and spring semesters and (2) a three-year, part-time course of study with courses during the fall and spring semesters and two summer sessions. There are two method options: (1) Direct Practice with a focus on work with individuals, families, and groups and (2) Community Partnerships with a focus on administration and community development. Students are required to complete a total of 60 hours/17 courses: 9 courses in the foundational curriculum, 7 courses in the advanced curriculum, and 1 elective.

Other Relevant Information: The Council on Social Work Education, Commission of Accreditation has granted candidacy status to our MSW program. Candidacy is the first step toward initial accreditation. Students admitted during the academic year in which the program is granted candidacy will be seen as having graduated from an accredited program when the program is granted initial accreditation. Please check the department website for updates.

GRADUATE COURSES

SW 501 Social Welfare History
SW 502 Social Welfare Planning and Analysis
SW 505 Human Behavior and the Social Environment: Social Justice
SW 506 Human Behavior and the Social Environment: Individuals, Families, and Groups
SW 507 Human Behavior and the Social Environment: Organizations and Communities
SW 510 Research Methods for Social Work
SW 511 Evaluation of Social Work Interventions

SW 515 Child Welfare
SW 516 Addiction Recovery and Social Work Practice
SW 517 Social Work and Aging
SW 520 Foundation Practice with Individuals, Families, and Groups
SW 521 Social Work Practice with Organizations and Communities
SW 550 Advanced Social Work Practice with Families
SW 551 Social Work Practice with Children and Adolescents
SW 560 Advanced Social Work Practice with Communities
SW 561 Social Work Administration
SW 570 Social Work with Groups
SW 571 Community Mental Health
SW 580 Social Work Professional Seminar
SW 595 Special Topics in Social Work
SW 630 Independent Study in Social Work
SW 651 Social Work Internship I
SW 652 Social Work Internship II
SW 653 Social Work Internship III
SW 654 Social Work Internship IV
SW 688 Non-Thesis Masters Continuous Registration - Half Time Registration
SW 689 Non-Thesis Master Continuous Registration - Full Time Registration

Sociology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Sociology	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
T. N. Greenstein, Box 8107, 515.9006, ted_greenstein@ncsu.edu, Sociology & Anthropology

Distinguished Professor of Sociology and Anthropology: V. Aldige
Glaxo Wellcome Endowed Chair: C. S. Tittle
William Neal Reynolds Professor: R. C. Wimberley
William Neal Reynolds Professor Emeritus: L. B. Otto
William Neal Reynolds Professor Sociology: M. D. Schulman

Professors: M. P. Atkinson, L. R. Della Fave, T. N. Greenstein, T. J. Hoban, E. L. Kick, J. C. Leiter, P. L. McCall, R. L. Moxley, T. L. Parcel, A. L. Schiller, E. M. Woodrum, M. A. Zahn, J. J. Zuiches; ***Adjunct Professors:*** B. Risman, A. Thompson; ***Professors Emeriti:*** W. B. Clifford II, E. M. Crawford, T. N. Hobgood Jr., M. M. Sawhney; ***Associate Professors:*** F. Chen, R. F. Czaja, S. M. De Coster, R. L. Engen, S. C. Lilley, A. H. Ross, M. L. Schwalbe, W. R. Smith, M. Thomas, M. S. Thompson, R. J. Thomson, J. M. Wallace III; ***Adjunct Associate Professors:*** J. F. Thigpen, C. R. Zimmer; ***Associate Professors Emeriti:*** R. C. Brisson, A. C. Davis, M. L. Walek; ***Assistant Professors:*** D. T. Case, M. Crowley, R. S. Ellovich, S. M. Fitzpatrick, J. K. Jacka, A. Jorgenson, S. McDonald; ***Assistant Professors Emeriti:*** C. G. Dawson

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: W. A. Wolfram; ***Professors Emeriti:*** R. D. Mustian

The department offers Master's and doctoral programs in sociology designed to prepare students for academic, research, and applied careers. The programs are structured to provide an intellectually stimulating and academically rigorous, yet supportive, environment that emphasizes developing research skills through course work and close collaboration with faculty.

Admissions Requirements: In addition to general Graduate School requirements, applicants are required to provide a writing sample and should be intending to complete the Ph.D. degree in sociology. We routinely accept applications only for the fall semester. The completed application should be received no later than January 10 to ensure full consideration for assistantship support. Applications for spring admission are considered only under special circumstances.

Master's Degree Requirements: Applicants should have received/be receiving a Bachelor's degree from an accredited institution with a major in sociology. Other majors are considered, but students may have to make up deficiencies without credit. The M.S. requires a thesis, whereas a Master of Sociology (M.SOC.) requires six semester credit hours of practicum (supervised field placement in an organization or agency) and a research paper. A minor for both degrees is optional. Thirty (30) hours of credit is required to obtain a Master's degree.

Doctoral Degree Requirements: The Ph.D. requires a total of 72 credit hours. The degree normally requires a Master's in sociology. Doctoral students take core courses in theory and methods/analysis and select courses in two areas of specialization. Some course work from the Master's may be applied. A minor is optional.

Student Financial Support: Teaching and research assistantships are available on a competitive basis.

GRADUATE COURSES

SOC 505 Medical Sociology
SOC 508 Social Organization
SOC 509 Population Problems
SOC 513 Community Organization and Development
SOC 514 Developing Societies
SOC 520 Sociology of Religion
SOC 533 The Community
SOC 601 Seminar
SOC 610 Special Topics in Sociology
SOC 642 Practicum in Sociology
SOC 685 Master's Supervised Teaching
SOC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
SOC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
SOC 690 Master's Examination
SOC 693 Master's Supervised Research
SOC 695 Master's Thesis Research
SOC 696 Summer Thesis Research
SOC 699 Master's Thesis Preparation
SOC 701 Classical Sociological Theory
SOC 702 Contemporary Sociological Theory
SOC 703 Theory Construction
SOC(WGS) 704 Feminist Thought in the Social Sciences
SOC 707 Quantitative Sociological Analysis
SOC 708 Advanced Sociological Analysis
SOC 710 Teaching Sociology
SOC 711 Research Methods in Sociology I
SOC 712 Advanced Survey Research Methods
SOC 713 Applied Research
SOC 715 Qualitative Sociological Methods and Analysis
SOC 721 Deviant Behavior
SOC 722 Social Control
SOC 723 Research on Crime and Deviance
SOC 724 Crime and Collective Action
SOC 727 Comparative Societies
SOC 728 Social Systems and Planned Change
SOC 731 Survey of Family Sociology
SOC 732 Contemporary Family Theory and Research
SOC 736 Social Stratification
SOC(WGS) 737 Sociology of Gender
SOC 738 Race and Ethnic Inequality
SOC(WGS) 739 Social Psychology of Inequality
SOC 742 Social-Psychological Processes in Health and Illness
SOC 743 Psychiatric Sociology and Mental Health
SOC 744 Health Behavior and Interventions
SOC 746 Sociological Social Psychology
SOC 747 Social Psychology
SOC 752 Work and Industry
SOC 753 Formal Organizations
SOC 754 Economic Sociology
SOC 756 Sociological Analysis of Agricultural Development
SOC 757 Sociology of U.S. Agriculture
SOC 758 Rural Sociology
SOC 762 Urban Ecology
SOC 800 Professional Seminar
SOC 801 Seminar
SOC 810 Special Topics
SOC 885 Doctoral Supervised Teaching
SOC 890 Doctoral Preliminary Examination
SOC 893 Doctoral Supervised Research
SOC 895 Doctoral Dissertation Research

SOC 896 Summer Dissertation Research
SOC 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Soil Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Soil Science	Y		Y		Y		

GRADUATE FACULTY

M. G. Wagger, ***Department Head***

Director of Graduate Programs:
T. J. Smyth, Box 7619, 515.2838, jot_smyth@ncsu.edu, Soil Science

William Neal Reynolds Professor Emeritus: S. W. Buol, J. W. Gilliam

Professors: A. Amoozegar, S. W. Broome, D. K. Cassel, J. L. Havlin, D. L. R. Hesterberg, M. T. Hoover, G. D. Hoyt, H. J. Kleiss, D. L. Osmond, W. P. Robarge, T. J. Smyth, M. J. Vepraskas, M. G. Wagger; ***Professors (USDA):*** D. W. Israel; ***Professors Emeriti:*** M. G. Cook, F. R. Cox, G. A. Cummings, W. A. Jackson, E. J. Kamprath, L. D. King, G. S. Miner, C. D. Raper Jr., P. A. Sanchez, R. J. Volk, S. B. Weed, A. G. Wollum II; ***Associate Professors:*** D. A. Crouse, C. R. Crozier, D. L. Lindbo, R. A. McLaughlin, J. G. White; ***Associate Professors Emeriti:*** J. P. Lilly, G. C. Naderman Jr.; ***Assistant Professors:*** O. W. Duckworth, A. K. Graves, J. L. Heitman, W. Shi; ***Adjunct Assistant Professors:*** D. H. Hardy, R. O. Maguire, J. T. Walker

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: H. L. Allen, R. W. Skaggs; ***Professors Emeriti:*** C. B. Davey

Graduate students in soil science may specialize in the following subdisciplines: soil physics, soil chemistry; soil microbiology and biochemistry; soil fertility and plant nutrition; soil genesis, morphology and classification; soil and water management and conservation; forest soils, soil mineralogy; tropical soil management.

Admissions Requirements: Graduate students accepted in soil science must have a Bachelor's or Master's degree with a major in soil science or a closely related field and with a strong background in the biological and physical sciences.

Master of Science Degree Requirements: Requirements include a minimum of 30 semester hours of course work, including at least one credit, but not more than two credit hours, of seminar (SSC 601) and a minimum of two, but not more than six, credit hours of research (SSC 693 or SSC 695), successful completion of a research problem, submittal of a written thesis that documents the research, a comprehensive oral examination and presentation of a non-credit exit seminar.

Master of Soil Science Degree Requirements (non-thesis distance education program): Requirements include a minimum of 36 semester credit hours of graduate work with a minimum of six credit hours of a Master's project. One credit hour of seminar (SSC 601) is required.

Master of Soil Science Degree Requirements (non-thesis program): Requirements include a minimum of 36 semester credit hours of graduate work with a minimum of four, but not more than six, credit hours of Special Problems (SSC 620). One credit hour of seminar (SSC 601) is required and a maximum of two credit hours is acceptable.

Master of Natural Resources Requirements (non-thesis program): Requirements include a minimum of 32 semester credit hours consisting of 15 hours in core courses, 17 hours in Soil Science courses, and the completion of a Master's project. One credit hour of seminar (SSC 601) is also required. A minor is optional, although one-third of the credits should usually be in courses outside of the department.

Doctoral Degree Requirements: Ph.D. candidates must demonstrate the ability to undertake original research with minimal supervision and write a dissertation reporting the results of this research. There are no definite course requirements for the Ph.D. degree; however, a minimum of 72 graduate credit hours is required beyond the Bachelor's degree. The Plan of Graduate Work must contain at least one credit hour of seminar (SSC 801) and at least two credit hours of research (SSC 893 or SSC 895). The candidate must also pass a preliminary examination (written and oral components) and a final oral examination. A non-credit exit seminar is required. A minor is optional, although one-third of the credits should usually be in courses outside of the department.

Student Financial Support: The department has a number of assistantships available to students who have demonstrated a high level of academic aptitude or potential. All of the graduate assistantships are half time.

GRADUATE COURSES

SSC 511 Soil Physics
SSC 521 Soil Chemistry
SSC(MB) 532 Soil Microbiology
SSC 541 Soil Fertility
SSC 545 Remote Sensing Applications in Soil Science and Agriculture
SSC 551 Soil Morphology, Genesis and Classification
SSC 562 Environmental Applications of Soil Science
SSC 570 Wetlands Soils
SSC(BAE) 573 Hydrologic and Water Quality Modeling
SSC 590 Special Problems
SSC 601 Seminar
SSC 609 Colloquium
SSC 620 Special Problems
SSC 685 Master's Supervised Teaching
SSC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
SSC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
SSC 690 Master's Examination
SSC 693 Master's Supervised Research
SSC 695 Master's Thesis Research
SSC 696 Summer Thesis Research
SSC 699 Master's Thesis Preparation
SSC 701 Tropical Soils: Characteristics and Management
SSC 720 Soil and Plant Analysis
SSC 722 Advanced Soil Chemistry
SSC(CS,HS,TOX) 725 Herbicide Chemistry
SSC(CS,HS,TOX) 727 Herbicide Behavior in Soil and Water
SSC 753 Soil Mineralogy
SSC(BAE) 771 Theory of Drainage - Saturated Flow
SSC(FOR) 773 Forest Productivity: Edaphic Relationships
SSC(BAE) 774 Theory of Drainage - Unsaturated Flow
SSC(BAE) 780 Transport and Fate of Chemicals in Soils and Natural Waters
SSC 790 Special Topics
SSC 801 Seminar
SSC 809 Colloquium
SSC 820 Special Problems
SSC 885 Doctoral Supervised Teaching
SSC 890 Doctoral Preliminary Examination
SSC 893 Doctoral Supervised Research
SSC 895 Doctoral Dissertation Research
SSC 896 Summer Dissertation Research
SSC 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Specialized Veterinary Medicine

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Specialized Veterinary Medicine					Y		

GRADUATE FACULTY

Director of Graduate Programs:
D. C. Dorman, Box 8401, 513.6213, david_dorman@ncsu.edu, Specialized Veterinary Medicine

Burroughs Wellcome Distinguished Professor: J. E. Riviere

Professors: G. W. Almond, K. L. Anderson, C. E. Atkins, H. J. Barnes, E. B. Breitschwerdt, T. T. Brown Jr., J. M. Cullen, M. G. Davidson, G. A. Dean, H. A. Devine, M. J. Dykstra, L. N. Fleisher, O. J. Fletcher Jr., R. B. Ford, F. J. Fuller, T. M. Gerig, C. Grindem, J. S. Guy, B. Hammerberg, E. C. Hawkins, J. F. Levine, M. G. Levy, D. H. Ley, D. J. Meuten, N. A. Monteiro-Riviere, W. E. M. Morrow, E. J. Noga, T. Olivry, N. C. Olson, P. E. Orndorff, M. G. Papich, J. Piedrahita, M. C. Roberts, P. L. Sannes, D. Shea, B. Sherry, J. E. Smallwood, M. K. Stoskopf, L. P. Tate Jr., D. E. Thrall, M. B. Tompkins, W. A. F. Tompkins, A. A. Tsiatis, D. P. Wages; ***Research Professors:*** E. A. Havell, S. Kennedy-Stoskopf, M. C. McGahan; ***Adjunct Professors:*** G. R. Burleson, R. L. Cooper, M. W. Dewhirst, K. L. Dreher, R. Meeker, M. J. Selgrade, F. Welsch; ***Professors Emeriti:*** J. F. Roberts; ***Associate Professors:*** P. Arasu, R. E. Baynes, A. T. Blikslager, J. C. Bonner, M. Breen, B. A. Breuhaus, D. G. Bristol, D. K. Carver, M. T. Correa, P. Cowen, L. A. Degernes, P. W. Farin, R. E. Fish, K. Flammer, J. E. Gadsby, B. Gilger, E. M. Hardie, J. M. Horowitz, L. C. Hudson, S. L. Jones, B. W. Keene, J. M. Law, G. A. Lewbart, M. B. McCaw, N. Olby, S. C. Roe, W. J. Showers, B. D. Slenning, C. R. Swanson, S. L. Tonkonogy, S. L. Vaden, D. W. Watson, M. D. Whitacre; ***Adjunct Associate Professors:*** D. Dixon, D. C. Dorman, T. E. Eling, M. R. Loomis, J. A. Raleigh, J. M. Rhoads, R. C. Sills, R. J. Smialowicz; ***Assistant Professors:*** J. Barnes, A. L. Cannedy, T. C. Defrancesco, S. Y. Gardner, M. P. Gerard, J. Gookin, M. L. Hauck, B. D. Lascelles, K. E. Linder, D. J. Marcellin-Little, L. D. Martin, K. G. Mathews, K. R. Munana, S. A. C. Nelson, C. R. F. Pinto, D. Reddy, L. E. Williams; ***Research Assistant Professors:*** C. A. Harms, P. R. Hess; ***Clinical Assistant Professors:*** W. R. Redding; ***Visiting Assistant Professors:*** B. D. Hansen, R. Linnehan; ***Adjunct Assistant Professors:*** A. E. Bogan, D. E. Malarkey, P. Ren

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: S. M. Laster; ***Associate Professors:*** J. M. Hinshaw

The creation of the non-thesis Master's degree track (MSpVM) for the Veterinary Medicine Graduate Program was proposed to enhance scholarship and competitiveness of veterinarians completing advanced specialty training at the College. These programs are designed to provide experiences appropriate for certification in the specialty College related to their area of study. Clinical and diagnostic material handled through the Veterinary Teaching Hospital and affiliated units will provide the basis for this training. Courses will incorporate seminars, rounds and journal club activities; individual supervised training; independent study programs; and basic statistics and ethics. Many of the programs will require a project, publication, and oral exam to be completed as part of the requirements.

This ***optional*** track features an ***interdepartmental***, ***multidisciplinary*** approach to graduate training with participating graduate faculty from all four departments of the College of Veterinary Medicine. These faculty represent 17 discipline areas and will offer advanced training leading to the Master of Specialized Veterinary Medicine.

Each MSpVM student will have a unique graduate training program focused in his/her clinical specialty area and directed by a graduate committee comprising faculty experts from this clinical specialty and other specialty areas. Creation of the track will permit the College to document more clearly the effort that faculty commit to advanced training in 17 different veterinary specialties. The graduate track will help sustain the outstanding success the College has achieved in attracting the top national and international veterinary graduates for post-graduate clinical training.

Admission Requirements: Applicants must have a DVM/VMD degree from an accredited program and have a documented history of academic excellence. All applicants must meet minimum criteria for both the program and the NC State University Graduate School and be selected for participation in the track by the faculty of the specialty area identified by the applicant. Graduate Record Examination (GRE) scores may be required by specific specialty areas. Committee decisions will be based on academic performance while enrolled in a DVM/VMD program, letters of recommendation, professional experience, and perceived ability of the individual to complement the needs of our training program.

Specialty Areas: Each enrolled student will concentrate his/her studies in one of the existing clinical specialty training areas at the College of Veterinary Medicine. Additional training specialties may be created as warranted by demographic, economic and social changes that impact the profession.

Course Requirements: Students will complete 2 or 3 years of training depending on the requirements in the specific specialty area. The first year will predominately be spent participating in specialty training in the Veterinary Teaching Hospital, where students will receive supervised specialty training in the various clinical services offered by the VTH. During the first year, out of state students may enroll for fewer than 9 credits for the fall and spring semesters. Subsequently, students will complete the required 36 credit hours during the second and third year of their studies.

All students are required to complete 25 credit hours of general course requirements as well as additional elective course requirements in his/her specialty area. The general course requirements consist of:

Seminar/clinical rounds - 4 credit hours
Research - 4 credit hours
Supervised teaching (including rounds) - 1 credit hours
Supervised specialty training - 12 credit hours
Biostatistics - 3 credit hours
Professional ethics - 1 credit hour

The courses selected to complete the balance of the required 36 credit hours will be determined by the student and his/her advisory committee. The following courses represent those that could be used by MSpVM students to complete the credit hour requirements for their degree.

Courses

CBS 662 Bioethics
SVM 595 Special Topics (letter graded)
SVM 601 Seminar - SVM
SVM 610 Special Topics (s/u)
SVM 615 Adv SPTP - SVM
SVM 635 Adv Rdg - SVM (Journal Club)
SVM 650 Internship - SVM (Specialized Training)
SVM 685 Master Supervised Teaching (Clinics) - to meet the teaching credit requirement
SVM 686 Other Teaching - SVM (Rounds)
SVM 693 Master Supervised Research - to meet the research credit requirements
SVM 610D Biostatistics

NCSU Graduate Catalog

Statistics

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Statistics	Y		Y		Y		

GRADUATE FACULTY

S. G. Pantula, ***Department Head***

Director of Graduate Programs:
P. J. Arroway, Box 8203, 515.1955, pam_arroway@ncsu.edu, Statistics

William Neal Reynolds Professor: M. Davidian, Z. Zeng

Professors: B. B. Bhattacharyya, P. Bloomfield, D. D. Boos, C. Brownie, D. A. Dickey, T. M. Gerig, M. L. Gumpertz, J. M. Hughes-Oliver, J. F. Monahan, S. G. Pantula, K. H. Pollock, D. L. Solomon, L. A. Stefanski, W. H. Swallow, J. L. Thorne, A. A. Tsiatis; ***Research Professors:*** C. Arellano, N. Sedransk; ***Adjunct Professors:*** J. C. Brocklebank, J. R. Chromy, R. B. Conolly, L. B. Crowder, J. H. Goodnight, P. D. Haaland, N. L. Kaplan, P. H. Morgan, D. W. Nychka, E. A. Thompson, R. D. Wolfinger, S. S. Young; ***Professors Emeriti:*** F. G. Giesbrecht, H. J. Gold, A. H. Grandage, T. Johnson, L. A. Nelson, C. H. Proctor, C. P. Quesenberry, J. O. Rawlings, D. L. Ridgeway, R. G. Steel, J. L. Wasik, O. Wesler; ***Associate Professors:*** M. Fuentes, S. Ghosal, S. K. Ghosh, D. Martin, S. V. Muse, T. W. Reiland, C. E. Smith, D. Zhang; ***Adjunct Associate Professors:*** H. X. Barnhart, E. R. Hauser, J. M. Hoenig, A. S. Kosinski; ***Associate Professors Emeriti:*** A. C. Linnerud; ***Assistant Professors:*** P. J. Arroway, H. D. Bondell, K. Gross, L. Li, W. Lu, A. A. Motsinger, J. A. Osborne, E. A. Stone, J. Tzeng, H. (. Wang, K. S. Weems, H. Zhang; ***Research Assistant Professors:*** J. R. Thompson, R. Woodard; ***Adjunct Assistant Professors:*** G. Bobashev, M. G. Ehm, J. S. Kimbell, Y. Li, M. W. Lutz, E. R. Martin, M. O'Connell

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: W. R. Atchley, M. M. Goodman, A. R. Hall, M. W. Suh; ***Associate Professors:*** T. H. Emigh

Admission Requirements: The written statement should not exceed 500 words and should describe the applicant's academic and career goals as well as special interests in the area of statistics. GRE General Test scores are required. The well-prepared applicant to the department's Master's programs has good grades in a three-semester calculus sequence, a two-semester advanced calculus sequence, a semester of linear algebra and a two-semester sequence in probability and statistics. Some of these courses may be taken as part of the program, but this may result in lengthening the stay. Admission to the Ph.D. program is granted to those who have been admitted to the Master's program and have passed the qualifying exam. Individuals applying for fall enrollment and who wish to be considered for financial aid should have their completed applications in by no later than March 1 for fall enrollment or October 15 for spring. Applications arriving after that will be considered but may be assigned lower priority.

Master's Degree Requirements: All Master's programs in statistics require a minimum of 34 credit hours, of which 12 are first-year core (ST 512R, ST 521, ST 522, ST 552 and their labs), one is supervised consulting (ST 641), and at least nine are statistics and/or supporting electives. The remaining 12 hours are program dependent.

Doctoral Degree Requirements: The Ph.D. program in statistics requires 22 course credit hours beyond the master's, of which 12 are Ph.D. core (ST/MA 778, 779, ST 793 and ST 794), one is supervised consulting (ST

841), six are Ph.D.-level statistics electives, and three are supporting electives. Requirements for co-majors are individually tailored.

Student Financial Support: Departmental assistantships and fellowships are awarded each year on a competitive basis. Fellowships and supplements are provided through the department's Gertrude M. Cox Fellowship Fund. Approximately 40 teaching assistantships and 30 research assistantships and traineeships are available along with several graduate industrial traineeships supported by local industries. In addition, the department offers NSF-VIGRE traineeships to qualified U.S. students.

Other Relevant Information: With a large graduate faculty representing virtually all major statistical specializations, the department is recognized as a world leader in graduate education and research in statistics. Its applied orientation sets it apart from most other departments in the country, offering education to those wishing to pursue careers as consulting statisticians in industry and government, as well as to those seeking careers in research and teaching.

Areas of research specialization of the faculty and advanced graduate students include spatial statistics, time series, econometrics, statistical genetics and ecology, experiment design and analysis, sampling, environmental applications, statistical process and quality control, biostatistics, biomathematics, bioinformatics, statistical computing, nonparametric regression, robust and nonparametric inference, mathematical programming, Bayesian inference, multivariate analysis, decision theory and stochastic processes.

The department has excellent computation facilities consisting of two computing laboratories: the Statistics Instructional Computing Laboratory (SICL), used for instruction and course labs, and the Statistics Research Computing and Information System (SRCIS), a research facility maintained for the use of statistics graduate students.

GRADUATE COURSES

ST 505 Applied Nonparametric Statistics
ST(ZO) 506 Sampling Animal Populations
ST 507 Statistics for the Behavioral Sciences I
ST 508 Statistics for the Behavioral Sciences II
ST 511 Experimental Statistics for Biological Sciences I
ST 512 Experimental Statistics for Biological Sciences II
ST 513 Statistics for Management I
ST 514 Statistics for Management and Social Sciences II
ST 515 Experimental Statistics for Engineers I
ST 516 Experimental Statistics for Engineers II
ST 520 Statistical Principles of Clinical Trials and Epidemilogy
ST 521 Statistical Theory I
ST 522 Statistical Theory II
ST 524 Statistics in Plant Science
ST 535 Statistical Process Control
ST 536 Off-line Quality Control
ST(MA) 546 Probability and Stochastic Processes I
ST 552 Linear Models and Variance Components
ST(ECG) 561 Intermediate Econometrics
ST 590 Special Topics
ST 601 Seminar
ST 610 Topics in Statistics
ST 620 Special Problems
ST 625 Advanced Special Problems
ST 630 Independent Study
ST 635 Readings
ST 641 Statistical Consulting
ST 685 Master's Supervised Teaching
ST 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ST 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ST 690 Master's Examination

ST 693 Master's Supervised Research
ST 695 Master's Thesis Research
ST 696 Summer Thesis Research
ST 699 Master's Thesis Preparation
ST(MA,OR) 706 Nonlinear Programming
ST 708 Applied Least Squares
ST 711 Design of Experiments
ST 714 Life-testing and Reliability
ST 715 Theory of Sampling Applied to Survey Design
ST(GN) 721 Genetic Data Analysis
ST(BMA,OR) 722 Decision Analytic Modeling
ST 730 Applied Time Series Analysis
ST 731 Applied Multivariate Statistical Analysis
ST 732 Applied Longitudinal Data Analysis
ST 733 Applied Spatial Statistics
ST 740 Bayesian Inference and Analysis
ST 744 Categorical and Censored Data Analysis
ST 745 Analysis of Survival Data
ST(MA) 746 Introduction to Stochastic Processes
ST(MA) 747 Probability and Stochastic Processes II
ST(MA) 748 Stochastic Differential Equations
ST 750 Statistical Computing
ST(ECG) 751 Econometric Methods
ST(ECG) 752 Time Series Econometrics
ST(ECG) 753 Microeconometrics
ST 755 Advanced Analysis of Variance and Variance Components
ST(GN) 756 Computational Molecular Evolution
ST(BI,GN) 757 Statistics for Molecular Quantitative Genetics
ST 760 Advanced Topics in Construction and Analysis of Experimental Designs
ST 762 Nonlinear Statistical Models for Univariate and Multivariate Response
ST(GN) 770 Statistical Concepts in Genetics
ST(BMA,MA) 771 Biomathematics I
ST(BMA,MA) 772 Biomathematics II
ST(BMA,MA,OR) 773 Stochastic Modeling
ST(MA) 778, 779 Measure Theory and Advanced Probability I, II
ST 782 Time Series Analysis: Time Domain
ST 783 Time Series Analysis: Frequency Domain
ST 784 Multivariate Analysis
ST 785 Introduction to Statistical Decision Theory
ST 790 Advanced Special Topics
ST 793 Advanced Statistical Inference I
ST 794 Advanced Statistical Inference II
ST 801 Seminar
ST 820 Special Problems
ST 825 Advanced Special Problems
ST 841 Statistical Consulting
ST 885 Doctoral Supervised Teaching
ST 890 Doctoral Preliminary Examination
ST 893 Doctoral Supervised Research
ST 895 Doctoral Dissertation Research
ST 896 Summer Dissertation Research
ST 899 Doctoral Dissertation Preparation

Textile and Apparel Management

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Textile and Apparel, Technology and Management			Y		Y		

GRADUATE FACULTY

T. J. Little, ***Department Head***

Director of Graduate Programs:
G. L. Hodge, Box 8301, 515.6579, george_hodge@ncsu.edu, Textile & Apparel Management

Charles A. Cannon Professor of Textiles: S. K. Batra
Director of Graduate Programs and Abel C. Linberger Prof. of Yarn Manufacturing: W. Oxenham
Klopman Distinguished Professor Emeritus: S. C. Winchester, Jr.
Professor (Dean) and Joseph D. Moore Professorship of Textile and Apparel Management: A. B. Godfrey
William A. Klopman Distinguished Professor: B. Pourdeyhimi

Professors: N. L. Cassill, R. A. Donaldson, T. K. Ghosh, M. W. King, T. J. Little, A. M. Seyam, M. W. Suh; ***Adjunct Professors:*** T. W. Theyson; ***Professors Emeriti:*** R. A. Barnhardt, A. H. M. El-Shiekh, M. H. M. Mohamed, W. C. Stuckey Jr.; ***Associate Professors:*** P. Banks-Lee, K. T. Barletta, H. H. A. Hergeth, G. L. Hodge, C. L. Istook, T. M. Lamar, S. Michielsen, N. B. Powell, G. W. Smith; ***Adjunct Associate Professors:*** D. Shiffler; ***Associate Professors Emeriti:*** H. A. Davis, P. B. Hudson, M. L. Robinson Jr.; ***Assistant Professors:*** M. R. Jones, H. J. Lee; ***Visiting Assistant Professors:*** E. Shim, H. Vahedi Tafreshi; ***Adjunct Assistant Professors:*** L. Qian

The Department of Textile and Apparel, Technology and Management offers the Master of Science in Textiles and the Master of Textiles degrees. Textiles includes the design, management, and technology of fiber-based products and processes. Textile design students explore issues in new product development, body scanning, direct digital printing, computer animation, and computer aided design (CAD). Textile management includes such topics as business intelligence, business finance, information systems, international marketing, supply chain management, and total quality management. Medical textiles, industrial fabrics, three-dimensional textile structures, aerospace applications, and smart textiles and nonwovens are examples of new areas for textile technology.

The objective of the Master of Science in Textiles is to develop the student's potential for research and the technical and analytical skills needed for the design of new products and processes and for careers in the textile supply chain, in research laboratories, in government agencies, and in higher education. The MS degree is a thesis-based 36-credit-hour program where students conduct independent investigation. Students may specialize in the following areas: *advanced fibrous structures, medical textiles, nonwovens, textile product design, textile technology, and textile technology management*. Students interested in continuing with a Ph.D. are encouraged to pursue the MS degree.

The objective of the Master of Textiles is to provide on- and off-campus students with an opportunity to strengthen their educational background and prepare them for productive careers in the textile supply chain, in research laboratories, in government agencies, and in higher education. The Master of Textiles is a non-thesis degree. The program is flexible to accommodate a breadth of student needs. The program can be completed in only two semesters of full-time on-campus study. The program is also available entirely via distance education (Textile Off-Campus Programs: TOP) and may be completed on a part-time basis. The university residency requirement is waived for this distance education program. The degree requires 30 credit hours of study with a

final oral examination.

Students should have 20 credit hours from mathematics and natural sciences in their undergraduate degree. Students with a Bachelor of Science or a Bachelor of Arts degree may apply to either of the degree programs. Students apply with undergraduate degrees in textiles, engineering, management, or design. Graduate courses in advanced fibrous structures, nonwovens, medical textiles, and some advanced textile technology courses may require advanced mathematics or science courses.

Master's Degree Requirements: The MS degree is a thesis-based 36-credit-hour program where students conduct independent investigation. Students may specialize in the following areas: *advanced fibrous structures, medical textiles, textile product design, textile technology, and textile technology management.* Students interested in continuing with a Ph.D. are encouraged to pursue the MS degree. The non-thesis Master of Textiles requires a minimum of 30 credit hours. No supporting (minor) courses are required. The student must pass a final oral examination.

Student Financial Support: Financial aid in the form of assistantships may be available for full-time Master of Science students.

Other Relevant Information: The Department of Textile and Apparel Technology and Management currently houses the Nonwoven Cooperative Research Center (NCRC). This Center allows students to conduct research in new technologies for nonwoven fabric manufacture. The National Textile Research Center, a collaboration among eight universities, allows students to conduct research in a variety of management, manufacturing, technology and engineering applications. The TATM department includes a Digital Design lab which specializes in 3D Body Scanning, Direct Digital Printing, Whole Body Knitted Garments, and Computer Aided Apparel and Fabric Design. In addition to the design lab the Sara Lee Knit Products Apparel Lab, a Braiding Lab and a Weaving Lab allows students to experience hands on management of advanced textile technology.

GRADUATE COURSES

TT 500 Understanding the Textile Complex
TT 503 Materials, Polymers, and Fibers Used in Nonwovens
TT 504 Introduction to Nonwovens Processes and Products
TT 505 Advanced Nonwovens Processing
TT 506 Bonding Principles in Nonwovens
TT 507 Nonwoven Characterization Methods
TT 508 Nonwoven Product Development
TT 520 Yarn Processing Dynamics
TT(TE,TMS) 521 Filament Yarn Production Processing and Properties
TT(TTM) 530 Textile Quality and Process Control
TT 532 Evaluation of Biotextiles
TT(TTM) 535 Research Methods and Management
TT(TE) 541 Theory and Practice of Knitted Fabric Production and Control
TT(TE) 549 Warp Knit Engineering and Structural Design
TT 550 Production Mechanics and Properties of Woven Fabrics
TT 551 Advanced Woven Fabric Design and Structures
TT 552 Formation, Structure and Assembly of Medical Textile Products
TT 570 Textile Digital Design and Technology
TT 571 Professional Practices in Textile Design and Technology
TT 581 Technical Textiles
TT 591 Special Studies in Textile Technology
TT 601 Seminar
TT 630 Independent Study in Textile Technology
TT 676 Special Projects in Textile Technology
TT 685 Master's Supervised Teaching
TT 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
TT 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
TT 690 Master's Examination
TT 693 Master's Supervised Research

TT 695 Master's Thesis Research
TT 696 Summer Thesis Research
TT 699 Master's Thesis Preparation
TT(FPS) 720 Yarn Production/Properties: Advanced Topics
TT(FPS) 721 Total Quality Management in Textiles
TT(FPS) 750 Advances in Woven Fabric Formation and Structure
TT(FPS) 781 Mechanics of Twisted Structures
TT(FPS) 782 Mechanics of Fabric Structures

TTM 501 Textile Enterprise Integration
TTM 502 Supervisory Control and Data Acquisition Systems for Textile Manufacturing
TTM 531 Total Quality Management in Textiles
TTM(TT) 535 Research Methods and Management
TTM 561 Strategic Technology Management in the Textile Complex
TTM 573 Management of Textile Product Development
TTM 581 Global Textile and Apparel Business Dynamics
TTM(BUS) 585 Market Research in Textiles
TTM 586 Advanced Textile Labor Management Seminar
TTM 588 Global Perspectives in Textiles Supply Chain Management
TTM 591 Special Studies in Textile Technology Management
TTM 601 Seminar
TTM 630 Independent Study in Textile Technology Management
TTM 676 Special Projects in Textile Technology Management
TTM 685 Master's Supervised Teaching
TTM 690 Master's Examination
TTM 693 Master's Supervised Research
TTM 695 Master's Thesis Research
TTM 699 Master's Thesis Preparation
TTM(FPS) 730 Measurement and Evaluation of Textile Properties
TTM(FPS) 761 Supply Chain Management and Information Technology in the Textile Complex
TTM 786 Advanced Textile Labor Management Seminar
TTM 787 Competitive Strategy and Planning for the Textile Firm

Textile Engineering, Chemistry and Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Textile Chemistry			Y				
Textile Engineering			Y				

GRADUATE FACULTY

K. R. Beck, ***Department Head***

Director of Graduate Programs:
P. J. Hauser, Box 8301, 513.1899, peter_hauser@ncsu.edu, Textile Engr., Chem, & Science

Burlington Industries Professor of Textile Technology: R. L. Barker
Ciba-Geigy Distinguished Professor and Associate Dean for Research: H. S. Freeman
Kosa Professor of Fiber and Polymer Chemistry: A. E. Tonelli
William A. Klopman Distinguished Professor: B. Pourdeyhimi

Professors: K. R. Beck, T. G. Clapp, B. S. Gupta, H. Hamouda, P. J. Hauser, S. M. Hudson, W. J. Jasper, J. P. Rust; ***Visiting Professors:*** L. D. Claxton; ***Adjunct Professors:*** A. Bogdanovich, W. G. O'Neal; ***Professors Emeriti:*** D. R. Buchanan, J. A. Cuculo, A. H. M. El-Shiekh, P. L. Grady, S. P. Hersh, C. D. Livengood, R. McGregor, G. N. Mock, M. H. M. Mohamed, C. B. Smith, M. H. Theil, C. Tomasino, P. A. Tucker Jr.; ***Associate Professors:*** D. Hinks, J. A. Joines, R. E. Kotek, M. G. McCord, R. Shamey; ***Adjunct Associate Professors:*** T. G. Montgomery; ***Assistant Professors:*** R. E. Gorga, W. E. Krause, M. Pasquinelli, X. Zhang; ***Adjunct Assistant Professors:*** H. Boyter Jr., R. A. Moore, L. Qian, H. S. Whang

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: S. K. Batra, W. Oxenham, B. Pourdeyhimi, R. A. Donaldson, R. E. Fornes, T. K. Ghosh, R. J. Spontak, M. W. Suh; ***Professors Emeriti:*** R. A. Barnhardt, H. G. Olf; ***Associate Professors:*** P. Banks-Lee

Master of Science in Textile Chemistry *(MS/TC):* The M.S. in textile chemistry program offers unique educational and research opportunities in textile and polymer chemistry. Fundamentals of chemistry, physics, and mathematical sciences are applied to solve polymer science, textile wet processing, and color science problems.

Master of Science in Textile Engineering *(MS/TE)*: The M.S. in textile engineering offers unique educational and research opportunities in machine, process and product design, as well as Six-Sigma quality improvement. Fundamentals of physics, engineering, and mathematical sciences are applied to textile-related problems.

Admission Requirements. *(MS/TC)*: Applicants must have a physical science or engineering background, including physical chemistry and differential equations. Formal education in textile or polymer chemistry is desired but not required. *(MS/TE)*: Applicants must have a physical science or engineering background including differential equations. A background in engineering mechanics, control theory, statistics, and material science is highly recommended. Formal education in textile engineering or materials science is desired but not required.

Degree Requirements. *(MS/TC)*: Normally, this degree requires 15 credit hours in textile chemistry, 9 credit hours in a supporting area (minor), 6 credit hours of thesis research, and two semester credits from the College Seminar (TC 601). Additional course work may be substituted for part of the research credits. For off-campus

(TOP) students and students earning the M.S. on the way to the Ph.D. degree in Fiber and Polymer Science (FPS); a thesis is optional and a minimum of 33 credit hours is required. *(MS/TE)*: Normally, this degree requires 15 credit hours in textile engineering/textile materials science, 9 credit hours in a supporting area (minor), 6 credit hours of thesis research, and two semester credits from the College Seminar (TE 601). Additional course work may be substituted for part of the research credits. For off-campus (TOP) students and students earning the M.S. on the way to the Ph.D. degree in Fiber and Polymer Science (FPS); a thesis is optional and a minimum of 30 credit hours is required.

Student Financial Support: Financial aid in the form of assistantships and fellowships is normally available for all full-time students.

Other Relevant Information: The department either houses or has access to all major analytical tools necessary to conduct a quality research program covering a wide range of topics. It also houses state-of-the-art facilities for conducting research in fiber science and textile engineering. Close cooperation between College faculty and the fiber/textile and allied industries provides students with opportunities for learning and employment.

GRADUATE COURSES

TC 502 Textile Wet Processing
TC 530 The Chemistry of Textile Auxiliaries
TC(MSE) 561 Organic Chemistry of Polymers
TC 565 Polymer Applications and Technology
TC(TE,TMS) 589 Special Studies in Textile Engineering and Science
TC 601 Seminar
TC 630 Independent Study
TC 685 Master's Supervised Teaching
TC 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
TC 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
TC 690 Master's Examination
TC 693 Master's Supervised Research
TC 695 Master's Thesis Research
TC 696 Summer Thesis Research
TC 699 Master's Thesis Preparation
TC 704 Fiber Formation--Theory and Practice
TC 705 Theory of Dyeing
TC 706 Color Science
TC 707 Color Laboratory
TC 720 Chemistry of Dyes and Color
TC 721 Dye Synthesis Laboratory
TC(CH,MSE) 762 Physical Chemistry of High Polymers--Bulk Properties
TC(CHE) 769 Polymers, Surfactants and Colloidal Materials
TC 771 Polymer Microstructures, Conformations and Properties
TC(CH,MSE) 772 Physical Chemistry of High Polymers--Solution Properties
TC(CHE) 779 Diffusion in Polymers
TC 791 Special Topics in Textile Science
TC(TE) 792 Special Topics in Fiber Science
TE 501 Analysis and Design of Yarn Production Systems
TE 502 Dynamics of Fabric Production Systems
TE 505 Textile Systems and Control
TE(TMS) 565 Textile Composites
TE 566 Polymeric Biomaterials Engineering
TE(TC) 589 Special Studies in Textile Engineering and Science
TE 601 Seminar
TE 602 Textile Technology Seminar
TE 630 Independent Study
TE 676 Special Projects
TE 685 Master's Supervised Teaching
TE 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
TE 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
TE 690 Master's Examination

TE 693 Master's Supervised Research
TE 695 Master's Thesis Research
TE 696 Summer Thesis Research
TE) 699 Master's Thesis Preparation
TE(ECE,MAE) 717 Multivariable Linear Systems Theory
TMS 500 Fiber and Polymer Microscopy
TMS 761 Mechanical and Rheological Properties of Fibrous Material
TMS 762 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures
TMS(MSE) 763 Characterization of Structure of Fiber Forming Polymers

NCSU Graduate Catalog

Textile Technology Mgmt

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Textile Technology Management	Y						

GRADUATE FACULTY

Director of Graduate Programs:
W. Oxenham, Box 8301, 515.6573, william_oxenham@ncsu.edu, College of Textiles

Alan T. Dickson Distinguished University Professor: M. A. Rappa
Bank of America University Distinguished Professor: R. B. Handfield
Burlington Industries Professor of Textile Technology: R. L. Barker
Charles A. Cannon Professor of Textiles: S. K. Batra
Ciba-Geigy Distinguished Professor and Associate Dean for Research: H. S. Freeman
Director of Graduate Programs and Abel C. Linberger Prof. of Yarn Manufacturing: W. Oxenham
James T. Ryan Prof of Industrial Engineering: T. J. Hodgson
Klopman Distinguished Professor Emeritus: S. C. Winchester, Jr.
Kosa Professor of Fiber and Polymer Chemistry: A. E. Tonelli
Professor (Dean) and Joseph D. Moore Professorship of Textile and Apparel Management: A. B. Godfrey
University Professor: S. E. Elmaghraby
Walter Clark Chair Professor of IE and Director of Graduate Programs IE: S. Fang
William A. Klopman Distinguished Professor: B. Pourdeyhimi

Professors: K. R. Beck, N. L. Cassill, T. G. Clapp, R. A. Donaldson, T. K. Ghosh, B. S. Gupta, H. Hamouda, P. J. Hauser, D. M. Holthausen Jr., W. J. Jasper, M. W. King, R. E. King, T. J. Little, S. E. Margolis, M. Montoya-Weiss, J. P. Rust, A. M. Seyam, M. W. Suh, J. R. Wilson; ***Professors Emeriti:*** R. A. Barnhardt, D. R. Buchanan, J. R. Canada, A. H. M. El-Shiekh, P. L. Grady, S. P. Hersh, C. D. Livengood, G. N. Mock, M. H. M. Mohamed, H. L. Nuttle, C. B. Smith, C. Tomasino, P. A. Tucker Jr.; ***Associate Professors:*** P. Banks-Lee, K. T. Barletta, C. C. Bozarth, S. N. Chapman, H. H. A. Hergeth, D. Hinks, G. L. Hodge, C. L. Istook, J. A. Joines, R. E. Kotek, T. M. Lamar, J. K. McCreery, S. Michielsen, N. B. Powell, R. Shamey, G. W. Smith; ***Assistant Professors:*** R. E. Gorga, M. R. Jones, W. E. Krause; ***Visiting Assistant Professors:*** E. Shim

Textile Technology Management is a multidisciplinary program designed to educate students for research and management careers in technology management in the fiber, textile, apparel and related industries complex. The program is designed to give the students a breadth of knowledge of the materials and technologies employed in the industries as well as the quantitative and analytical tools of management.

Admission Requirements: Students majoring in textiles; industrial, systems and manufacturing engineering; statistics; operations research; computer science; economics; consumer economics; marketing; and business administration, and having an average in their undergraduate studies of 3.5/4.0 and a Master's degree will normally qualify for admission. Exceptionally qualified students (3.75/4.0 undergraduate GPA) may be admitted directly without a Master's degree.

Doctoral Degree Requirements: Fixed credit-hour requirements for the Doctor of Philosophy degree are 72. (Up to 18 hours from an M.S. may be applied against the 72.) Students are admitted to candidacy for the Ph.D. degree after passing two preliminary written and oral examinations (the first covering manufacturing technology and the second the management of technology) and orally defending a research proposal. They must also have passed an English technical writing course during their college career and, depending on the nature of their research interests, may also be required to demonstrate a reading knowledge of one foreign language.

Student Financial Support: Financial aid in the form of assistantships and fellowships is normally available for all U.S. full-time students. Financial aid in the form of Graduate Research/Teaching Assistantships may be available to a limited number of international students.

Course Offerings: Extensive use may be made of graduate course offerings in other colleges on campus when developing the minor field. See departmental listing for descriptions.

GRADUATE COURSES

FPS(TT) 781 Mechanics of Twisted Structures
FPS(TT) 782 Mechanics of Fabric Structures
TT 500 Understanding the Textile Complex
TT 503 Materials, Polymers, and Fibers used in Nonwovens
TT 504 Introduction to Nonwovens Processes and Products
TT 505 Advanced Nonwovens Processing
TT 506 Bonding Principles in Nonwovens
TT 507 Nonwoven Characterization Methods
TT 508 Nonwoven Product Development
TT 520 Yarn Processing Dynamics
TT (TE,TMS) 521 Filament Yarn Production Processing and Properties
TT(TTM) 530 Textile Quality Control
TT 541 Theory and Practice of Knitted Fabric Production and Control
TT 549 Warp Knit Engineering and Structural Design
TT 550 Production Mechanics and Properties of Woven Fabrics
TT 551 Advance Woven Fabric Design & Structure
TT 552 Formation, Structure and Assembly of Medical Textile Products
TT 570 Textile Digital Design and Technology
TT 571 Professional Practices in Textile Design and Technology
TT 581 Technical Textiles
TT 591 Special Studies in Textile Technology
TT(FPS) 720 Yarn Production/Properties: Advanced Topics
TT(FPS) 750 Advances in Woven Fabric Formation and Structure
TTM 501 Textile Enterprise Integration
TTM 502 Supervisory Control and Data Acquisition Systems for Textile Manufacturing
TTM 510 Apparel Technology Management
TTM 515 Apparel Production
TTM(TT) 530 Textile Quality and Process Control
TTM 531 Total Quality Management in Textiles
TTM(TT) 535 Research Methods and Management
TTM 561 Strategic Technology Management in the Textile Complex
TTM 573 Management of Textile Product Development
TTM 581 Global Textile and Apparel Business Dynamics
TTM 583 Strategic Planning for Textile Firms
TTM(BUS) 585 Market Research in Textiles
TTM 588 Global Perspectives in Textiles Supply Chain Management
TTM 591 Special Studies in Textile Technology Management
TTM(FPS) 730 Measurement and Evaluation of Textile Properties
TTM 761 Supply Chain Management and Information Technology in the Textile Complex
TTM 786 Advanced Textile Labor Management Seminar
TTM 801 Seminar
TTM 830 Independent Study
TTM 876 Special Projects in Textile Technology Management
TTM 885 Doctoral Supervised Teaching
TTM 890 Doctoral Preliminary Examination
TTM 893 Doctoral Supervised Research
TTM 895 Doctoral Dissertation Research
TTM 896 Summer Dissertation Research
TTM 899 Doctoral Dissertation Preparation

Toxicology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Toxicology	Y		Y		Y		

GRADUATE FACULTY

Director of Graduate Programs:
R. C. Smart, Box 7633, 515.7245, robert_smart@ncsu.edu, Toxicology

Distinguished Professor Emeritus: E. Hodgson

Professors: E. Guthrie-Nichols, G. A. LeBlanc, D. Shea, R. C. Smart; ***Research Professors:*** A. R. Brody; ***Adjunct Professors:*** J. A. Bond, N. Chernoff, H. Cunny, J. E. Gibson, J. A. Goldstein, L. E. Gray, W. F. Greenlee, K. S. Korach, R. J. Langenbach, R. O. McClellan, R. J. Preston, M. J. Selgrade, A. J. Tobia, D. C. Zeldin; ***Professors Emeriti:*** R. B. Leidy, T. J. Sheets; ***Associate Professors:*** J. C. Bonner, W. G. Cope; ***Research Associate Professors:*** N. Deighton; ***Adjunct Associate Professors:*** A. E. Chalmers, K. M. Crofton, T. E. Eling, B. A. Merrick, R. T. Miller, B. Veronesi; ***Assistant Professors:*** D. Buchwalter, C. S. Hofelt, S. W. Kullman, S. D. McCulloch, H. B. Patisaul, J. Tsuji, Y. Tsuji, A. Wallace; ***Research Assistant Professors:*** P. D. McClellan-Green; ***Adjunct Assistant Professors:*** D. J. Dix, M. F. Oleksiak

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: R. M. Roe, K. B. Adler, J. M. Cullen, H. M. Hassan, S. M. Laster, N. A. Monteiro-Riviere, P. L. Sannes, M. K. Stoskopf; ***Associate Professors:*** R. E. Baynes, J. M. Horowitz, M. Hyman, J. M. Law; ***Assistant Professors:*** M. Rodriguez-Puebla

The Department of Environmental and Molecular Toxicology provides a comprehensive program in course work and research training to prepare prospective toxicologists for careers in academia, government, and industry. Research in the department spans an array of topics ranging from the molecular to population level consequences of toxicant exposure. A common research theme in the department involves the elucidation of toxicant induced alterations in cell signaling and resultant changes in gene expression as it relates to toxicity at the cellular, organ and organism level. Linkage of adverse biological endpoints to toxicant exposure is a mechanistic goal. Specific research areas include: endocrine disruption, oxidative stress, cellular signaling pathways, transcriptional regulation, toxicogenomics, regulation and expression of xenobiotic metabolizing enzymes, molecular carcinogenesis, cell cycle regulation, apoptosis, chemical exposure assessment, analytical toxicology, ecotoxicology and risk assessment.

Admission Requirements: Prospective students should have a strong background in the biological and physical sciences with a minimum undergraduate grade point average of 3.0 (on a 4.0 scale) and a minimum GRE score of 1100 (combined Verbal and Quantitative scores). GRE subject tests are not required. International students whose primary language is not English must submit TOEFL scores. A written statement should describe the applicant’s academic and career goals as well as their area of interest. All applications are reviewed by a departmental committee and the best applicants will be accepted until all available spaces are filled. Students are encouraged to submit applications in early January for Fall admission.

Master of Science Degree Requirements: The M.S. is a research-oriented degree requiring a minimum of 30 credit hours and a written thesis. At least 20 credit hours must be graduate-level courses and a core curriculum is required.

Master of Toxicology Degree Requirements: The MTOX degree is a non-research degree designed for those not intending to pursue a career in research, part-time students, and/or working professionals seeking to further their education and advance their careers. A minimum of 30 credit hours is required, with at least 14 credit hours in toxicology courses. While a thesis is not required, at the discretion of the student's advisor, a review paper focusing on the student's interest in some aspect of toxicology might be required. Unlike the M.S. degree, the MTOX degree is an Option B degree program and does not require a thesis, an advisory committee or a final oral comprehensive exam.

Doctoral Degree Requirements: The Ph.D. program is designed to train students to become independent scholars capable of conducting unsupervised and original research. Students enroll in a core curriculum similar to that of the M.S .degree and additional courses as determined by his/her advisory committee. Normally a total of 72 credit hours is required, with the majority of these credits being dissertation research. Students must pass both a written and oral preliminary exam prior to advancing to Ph.D. candidacy. A doctoral dissertation presenting the student's original research is written and defended in a final oral examination.

Student Financial Support: Financial assistance is available for qualified applicants through traineeships, fellowships, teaching assistantships and research assistantships.

Other Relevant Information: Students pursuing either the M.S. or Ph.D. degree may elect to specialize in environmental toxicology or molecular and cellular toxicology. More details can be obtained on the Department of Environmental and Molecular Toxicology website.

GRADUATE COURSES

TOX 501 Principles of Toxicology
TOX 601 Seminar
TOX 620 Special Problems in Toxicology
TOX(ST) 621 Statistical Problems in Toxicology
TOX 628 Principles of Reproductive and Developmental Toxicology Research
TOX(BCH) 660 Free Radicals in Toxicology
TOX 685 Master's Supervised Teaching
TOX 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
TOX 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
TOX 690 Master's Examination
TOX 693 Master's Supervised Research
TOX 695 Master's Thesis Research
TOX 696 Summer Thesis Research
TOX 699 Master's Thesis Preparation
TOX 701 General Toxicology
TOX 704 Chemical Risk Assessment
TOX(IMM) 705 Immunotoxicology
TOX 710 Biochemical Toxicology
TOX 715 Environmental Toxicology
TOX 721 Chemical Carcinogenesis
TOX(ENT) 722 Insecticide Toxicology
TOX(CS,HS,SSC) 725 Pesticide Chemistry
TOX(CS,HS,SSC) 727 Pesticide Behavior and Fate in the Environment
TOX(CBS) 771 Cancer Biology
TOX 801 Seminar
TOX 820 Special Problems
TOX(BCH) 860 Free Radicals in Toxicology
TOX 885 Doctoral Supervised Teaching
TOX 890 Doctoral Preliminary Examination
TOX 893 Doctoral Supervised Research
TOX 895 Doctoral Dissertation Research
TOX 896 Summer Dissertation Research
TOX 899 Doctoral Dissertation Preparation

COURSES FROM ASSOCIATED DEPARTMENTS

BCH 553 Biochemistry of Gene Expression
BCH 701 Macromolecular Structure
BCH 703 Macromolecular Synthesis and Regulation
BCH 705 Molecular Biology of the Cell
BCH 761 Advanced Molecular Biology of the Cell
CBS 754 Principles of Analytical Epidemiology
CBS 762 Principles of Pharmacology
CBS 770 Cell Biology
CBS 787 Pharmacokinetics
CBS 795A Special Topics: Veterinary Pathology I. General Pathology
FW 707 Environmental Stress Physiology
GN 701 Molecular Genetics
MB 751 Immunology
MEA 540 Principles of Physical Oceanography
MEA 750 Marine Benthic Ecology
MEA 756 Ecology of Fishes
PHY 503 General Physiology I
PHY 504 General Physiology II
PHY 780 Mammalian Endocrinology
ST 511 Experimental Statistics for Biological Sciences I
ZO 513 Comparative Physiology
ZO 515 Fish Physiology
ZO 524 Comparative Endocrinology
ZO 714 Advanced Cell Biology
ZO 760 Principles of Ecology

Courses not listed above but approved by the student's advisory committee can also be included toward the 6 credit hour elective requirement. Course descriptions can be found at the Registration and Records website.

NCSU Graduate Catalog

Veterinary Public Health

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Veterinary Public Health					Y		

GRADUATE FACULTY

Director of Graduate Programs:
J. F. Levine, Box 8401, 513.6397, jay_levine@ncsu.edu, Veterinary Public Health

Burroughs Wellcome Distinguished Professor: J. E. Riviere

Professors: G. W. Almond, K. L. Anderson, H. J. Barnes, E. B. Breitschwerdt, J. S. Guy, B. Hammerberg, J. F. Levine, M. G. Levy, D. H. Ley, W. E. M. Morrow, M. G. Papich, M. C. Roberts, D. Shea, M. K. Stoskopf, A. A. Tsiatis, D. P. Wages; ***Research Professors:*** S. Kennedy-Stoskopf; ***Associate Professors:*** P. Arasu, R. E. Baynes, D. K. Carver, M. T. Correa, P. Cowen, P. W. Farin, R. E. Fish, J. M. Law, G. A. Lewbart, M. B. McCaw, W. J. Showers, B. D. Slenning, D. W. Watson; ***Research Assistant Professors:*** C. A. Harms

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: C. S. Apperson, H. A. Devine, T. M. Gerig; ***Professors (USDA):*** D. S. Marshall; ***Assistant Professors:*** S. A. C. Nelson, C. R. F. Pinto; ***Adjunct Assistant Professors:*** A. E. Bogan

The Master of Veterinary Public Health (MVPH) program is designed to provide graduate training for veterinarians interested in pursuing animal and public health service-oriented careers. The two-year non-thesis MVPH program provides advanced graduate training in: veterinary epidemiology and biostatistics; infection control and biosecurity; outbreak investigation, disease eradication; emergency program management, veterinary public health and the identification and control of zoonotic pathogens; food safety and security; geographic information systems, spatial analysis; and livestock health management and trade policy.

Admission Requirements: An applicant to the Master's program must have a degree in veterinary medicine or an equivalent degree from a college or school of veterinary medicine**.** The MVPH program admissions committee sometimes grants provisional admissions, as well as exceptions, under special circumstance. Applicants are accepted based on the recommendation of the MVPH program admissions committee and program director after a review of their prior academic performance, work experience, and letters of recommendation. No GRE exam is required for graduates of U.S. accredited colleges of veterinary medicine; however, we encourage the submission of GRE scores if available. International applicants from non-accredited colleges of veterinary medicine must meet the minimum TOEFL examination requirements of the NCSU graduate program and submit GRE examination scores.

Degree Requirements: Candidates for the Master of Public Health degree must complete 37 credit hours of core and elective courses, and conduct a project (fivecredits) related to some aspect of epidemiology, public health, biosecurity, food safety, or other relevant topic identified by the student and their faculty mentor.

Other relevant information: Students can enroll full time or part time. To take full advantage of course offerings and training opportunities, students are encouraged to enroll full time for two years.

GRADUATE COURSES

MVPH program students have the opportunity to take a wealth of classes offered by program faculty as well as

faculty from numerous other NCSU departments, the UNC Chapel Hill School of Public Health, and other North Carolina University Systems campuses. Each student is assigned a faculty mentor that assists with course selection and career planning. A partial list of classes available at NC State follows:

BMA 722 Decision Analytic Modeling
BMA 773 Stochastic Modeling
BMA 774 Partial Differential Equation Modeling in Biology
BMA 567 Modeling of Biological Systems
BUS 541 Strategic Information Technology
BUS 543 Database Management
BUS 545 Management Support Systems
BUS 549 Managerial Issues In Information Systems
BUS 550 Data Analysis & Forecasting Methods for Management
CBS 580 Veterinary Epidemiology
CBS 581 Veterinary Epidemiology Laboratory
CBS 610 Special Topics in Veterinary Medicine (PopMED Forum)
CBS 754 Principles of analytical epidemiology
CBS 810 Special Topics
FOR 554 Principles of Spatial Analysis
FS 520 Pre-Harvest Food Safety
FS 530 Post-Harvest Food Safety
FS 540 Food Safety and Public Health
FS 553 Food Laws and Regulations
FS 722 Microbial Food Safety
MEA 703 Atmospheric Aerosols
MEA 712 Mesoscale Modeling
MIS 601 Colloquium in International Development
PRT 555 Environmental Impacts of Recreation and Tourism
PRT 562 Principles of Geographic Information Systems
PRT 764 Advanced Study In Geographic Information Systems
SOC 758 Rural Sociology
SOC 762 Urban Ecology
ST 505 Applied Biostatistics
ST 506 Sampling Animal Populations
ST 511 Experimental Statistics for Biological Sciences
ST 512 Experimental Statistics for Biological Sciences II
ST 535 Statistical Process Control
ST 536 Off-line Quality Control
ST 546 Probability and Stochastic Processes I
ST 552 Linear Models and Variance Components
ST 706 Nonlinear Programming
ST 708 Applied Least Squares
ST 711 Design of Experiments
ST 714 Life-Testing and Reliability
ST 715 Theory of Sampling Applied to Survey Design
ST 721 Genetic Data Analysis
ST 722 Decision Analytic Modeling
ST 730 Applied Time Series Analysis
ST 731 Applied Multivariate Statistical Analysis
ST 732 Applied Longitudinal Data Analysis
ST 733 Applied Spatial Statistics
ST 740 Bayesian Inference and Analysis
ST 744 Categorical and Censored Data Analysis
ST 745 Analysis of Survival Data
ST 746 Introduction to Stochastic Processes
ST 747 Probability and Stochastic Processes II
ST 748 Stochastic Differential Equations
ST 750 Statistical Computing
TOX 704 Chemical Risk Assessment
VPH 554 Trade and Agricultural Health
VPH 555 Public Health, Sustainable Development and Gender in Global Context
VPS(FW) 720 Epidemiology of Wildlife Diseases
VPH(CBS) 760 Molecular Epidemiology of Infectious Diseases of Veterinary and Public Health Importance.
ZO 582 Medical and Veterinary Entomology

NCSU Graduate Catalog

Wood and Paper Science

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Wood and Paper Science	Y		Y		Y		

GRADUATE FACULTY

S. S. Kelley, ***Department Head***

Director of Graduate Programs:
R. A. Venditti, Box 8005, 515.6185, richard_venditti@ncsu.edu, Wood & Paper Science

Elis and Signe Olsson Professor of Wood and Paper Science: H. Jameel
Reuben B. Robertson Professor: H. Chang

Professors: D. Argyropoulos, V. L. Chiang, J. Denig, J. A. Heitmann Jr., M. A. Hubbe, S. S. Kelley, M. W. Kelly, A. G. Kirkman, M. J. Kocurek; ***Research Professors:*** R. L. Lemaster, J. S. Stewart; ***Visiting Professors:*** D. Saloni; ***Adjunct Professors:*** L. L. Edwards, T. W. Joyce, B. Kasal, R. B. Phillips; ***Professors Emeriti:*** E. L. Deal Jr., E. L. Ellwood, I. S. Goldstein, C. A. Hart, L. G. Jahn, H. G. Olf, R. G. Pearson, R. J. Thomas, E. A. Wheeler; ***Associate Professors:*** S. D. Jackson, L. Lucia, P. H. Mitchell, J. J. Pawlak, P. N. Peralta, I. Peszlen, O. J. Rojas, D. Tilotta, R. A. Venditti; ***Adjunct Associate Professors:*** S. Zauscher; ***Assistant Professors:*** M. V. Byrd, S. Dasmohapatra

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: E. B. Cowling, S. A. Khan

Course offerings and research facilities are available in the following areas: wood chemistry, biopolymer chemistry, bio-materials, bio-energy, pulping chemistry, process analysis, polymer chemistry, paper physics, paper recycling, wood physics (especially wood liquid relations), wood anatomy, wood biology, wood mechanics and engineering, wood machining, manufacturing processes, wood-based industry economics and marketing.

Admission Requirements: Requirements listed here are in addition to graduate school requirements stated elsewhere. To be admitted, a student should have earned a B.S. degree with a major in wood and paper science or another suitable science or engineering degree. Students with a 3.0 GPA and with appropriate course backgrounds will be considered for admission. The GRE test scores are required except for the Master's of Wood and Paper Science offered through Distance Education.

Master of Science Degree Requirements: The M.S. degree requires a minimum of 30 credit hours. In addition, there are WPS core course requirements, which vary depending on the field of study. Six hours of research (WPS 695) must be taken. Two hours of Seminar (WPS 591) must be passed. Qualifying exams, which vary depending on the field of study must be passed.

Master of Wood and Paper Science Degree Requirements: The Master of Wood and Paper Science is a non-thesis, professional degree for students not interested in research. The Master of Wood and Paper Science Degree is offered both on campus and through Distance Education. For the on-campus program a minimum of 36 course credits is required. The regulations regarding credits are the same as for the M.S. degree except that no credit for WPS 695 is required or given and up to six credits of 400-level courses in the major field may be included. A technical report, which demonstrates the student's ability to gather, analyze and report information

is required.

In addition to Graduate School requirements, the Distance Education program requires that the student be employed professionally in a wood or paper science or allied field, have one year of professional experience, and take required WPS core courses, which vary depending on the field of study. A minimum of 30 course credits is required including one hour of Seminar (WPS 591) and an independent project (WPS 625).

Doctoral Degree Requirements: In addition to Graduate School requirements, Ph.D. candidates must present two seminars (WPS 591 or WPS 791) before their final oral examination which will be arranged. Candidates must also pass qualifying exams, which vary depending on the field of study.

Student Financial Support: A number of research assistantships are available. Five Hoffman Fellowships are also available.

Other Relevant Information: Graduate students should select a chairman and other advisory committee members and submit a plan of graduate work by the end of their first semester of residence. They are also urged to take the qualifying examinations within one year of residence. These examinations are to ensure broad competence in the relevant areas of wood and paper science. The department believes M.S. and Ph.D. students should select a research topic and begin their thesis research as early as possible.

As the field of wood and paper science is a derived science, students are urged to develop a strong secondary area of excellence in one or more of the supporting disciplines such as organic chemistry, polymer chemistry, chemical engineering, mathematics, statistics, biology, engineering mechanics, mechanical engineering, physics, and economics or business administration.

GRADUATE COURSES

WPS 510 Strategic Business Processes for the Forest Products Industry
WPS 522 Chemical Principles for the Papermaking Process Engineer
WPS 527 Wet-end and Colloidal Chemistry
WPS(CE) 528 Structural Design in Wood
WPS(MAE) 534 Mechatronics Design
WPS 565 Paper Physics
WPS 577 Paper Coating and Printing
WPS 591 Master's Seminar
WPS 601 Seminar
WPS 620 Special Problems
WPS 625 Advanced Wood and Paper Science Problems
WPS 685 Master's Supervised Teaching
WPS 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
WPS 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
WPS 690 Master's Examination
WPS 691 Methods of Research in Wood and Paper Science
WPS 693 Master's Supervised Research
WPS 695 Master's Thesis Research
WPS 696 Summer Thesis Research
WPS 699 Master's Thesis Preparation
WPS 704 Timber Physics
WPS 713 Tropical Woods
WPS 715 Surface and Colloid Chemistry of Papermaking
WPS 721 Chemistry of Wood Polysaccharides
WPS 722 Chemistry of Lignin and Extractives
WPS 725 Pollution Abatement in Forest Products Industries
WPS 733 Advanced Wood Anatomy
WPS 740 Wood Composites
WPS 750 Wastewater Treatment in the Paper Industry
WPS 760 Advanced Pulp and Paper Process Analysis
WPS 791 Doctoral Seminar
WPS 801 Seminar

WPS 820 Special Problems
WPS 825 Advanced Wood and Paper Science Problems
WPS 885 Doctoral Supervised Teaching
WPS 890 Doctoral Preliminary Examination
WPS 691 Methods of Research in Wood and Paper Science
WPS 893 Doctoral Supervised Research
WPS 895 Doctoral Dissertation Research
WPS 896 Summer Dissertation Research
WPS 899 Doctoral Dissertation Preparation

NCSU Graduate Catalog

Zoology

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
Zoology	Y		Y		Y		

GRADUATE FACULTY

D. Shea, ***Interim Department Head***

Director of Graduate Programs:
H. V. Daniels, Box 7617, 515.4589, harry_daniels@ncsu.edu, Zoology

Professors: R. R. H. Anholt, B. L. Black, J. F. Gilliam, W. C. Grant, R. M. Grossfeld, T. L. Grove, H. F. Heatwole, C. F. Lytle, J. M. Miller, K. H. Pollock, R. A. Powell, J. A. Rice, C. V. Sullivan, H. A. Underwood Jr.; ***Professors (USDI/USFS):*** J. A. Collazo, J. E. Hightower, T. R. Simons; ***Adjunct Professors:*** L. B. Crowder, J. J. Govoni, L. E. Gray, D. E. Hoss, P. Kelley, J. G. Rogers; ***Professors Emeriti:*** G. T. Barthalmus, P. T. Bromley, B. J. Copeland, W. W. Hassler, G. C. Miller, R. L. Noble, T. L. Quay, J. F. Roberts, D. E. Smith, J. G. Vandenbergh; ***Associate Professors:*** R. J. Borski, J. A. Buckel, H. V. Daniels, J. Godwin, N. M. Haddad, J. M. Hinshaw, M. N. Niedzlek-Feaver; ***Associate Professors (USDI/USFS):*** T. J. Kwak; ***Adjunct Associate Professors:*** W. J. Fleming, R. M. Shelley, H. W. van der Veer; ***Assistant Professors:*** D. D. Aday, R. R. Dunn, B. J. Grubb, M. B. Hawkins, J. L. Lubischer, H. B. Patisaul; ***Adjunct Assistant Professors:*** E. M. Bennett, A. E. Bogan, D. R. Chalcraft, D. T. Cobb, L. B. Daniel III, J. A. Hare, R. W. Heise, M. S. Mitchell, K. W. Shertzer, W. C. Starnes

ASSOCIATE MEMBERS OF THE PROGRAM

Professors: P. D. Doerr, D. B. Eggleston, E. J. Jones, R. A. Lancia, T. M. Losordo, T. G. Wolcott; ***Associate Professors:*** W. G. Cope; ***Assistant Professors:*** K. Gross

Areas of study include: cell biology and physiology, ecology and behavior, and fisheries and wildlife biology. Specializations within these areas include developmental biology, neurobiology, genomics, invertebrate biology, animal reproduction, biorhythms, behavioral ecology, community ecology, population ecology, conservation biology, fisheries ecology, wildlife field studies, aquaculture and others.

Application Deadlines: To guarantee consideration for funding, applications should be complete by the following dates: for Fall Semester admission both U.S. and international applicants should have their application materials completed by February 15; for Spring Semester the deadline is September 15 for U.S. applicants and July 15 for international applicants. Please note that it typically requires four to six weeks from the date of your request until transcripts, letters of recommendation, and GRE scores reach us. Applications received after the dates listed above will still be considered until the Graduate School deadlines (June 25 and November 25 for U.S. applicants, March 1 and July 15 for international applicants), however, opportunities for funding may be limited (note that the Zoology Department does not accept M.S. and Ph.D. students without support).

Admission Requirements: GRE scores (general) are required for admission. M.S. students are expected to have a GRE score of at least 1000, calculated as the Verbal score plus the Quantitative score. Ph.D. students are expected to have a GRE score of at least 1200. Regular admission for a Master's degree requires an undergraduate grade point average of 3.0 in an appropriate biological discipline; an undergraduate GPA of at least 3.2 is expected for Ph.D. students. Some research experience is highly recommended.

Master's Degree Requirements: *M.S.:* No more than six hours of temporary courses (ZO 624, ZO 824) or two hours of departmental seminar can be included in the 30-hour requirement for the M.S. Six hours of research credits (ZO 695) resulting in a thesis are required. A minor (usually 9-10 hours) is optional. *Master of Zoology:* Of the 36 credit hours required, 20 must be regular courses at the 500-800 level, and four to six must be special problems (ZO 631). Other requirements may be imposed by the advisor.

Doctoral Degree Requirements: A student's advisory committee recommends appropriate courses which will provide a strong foundation in the student's area of interest. A minimum of 10 hours of research (ZO 895) leading to a dissertation is required. A minor (usually 9-10 hours) is optional.

Student Financial Support: Graduate teaching and research assistantships are available to well-qualified M.S. and Ph.D. students.

Other Relevant Information: Students may also pursue degrees in interdepartmental programs in Biomathematics, Physiology, and Fisheries and Wildlife Sciences. Excellent research facilities, equipment and computers are available. Off-campus research is conducted at the Pamlico Aquaculture Field Laboratory, research and extension centers in Eastern and Western North Carolina, the Center for Marine Science and Technology in Morehead City, and at facilities of state and federal agencies and private organizations. Field work can be conducted at nearby natural areas and laboratory work at various state and federal laboratories associated with the department. For additional information see the Zoology Department web page: www.cals.ncsu.edu/zoology/.

GRADUATE COURSES

ZO 501 Ornithology
ZO(PHY) 503 General Physiology I
ZO(PHY) 504 General Physiology II
ZO 508 Brain, Sex and Gender
ZO(ENT) 509 Ecology of Stream Invertebrates
ZO 512 Animal Symbiosis
ZO(PHY) 513 Comparative Physiology
ZO(FW) 515 Fish Physiology
ZO 519 Limnology
ZO 522 Biological Clocks
ZO(PHY,PO) 524 Comparative Endocrinology
ZO 542 Herpetology
ZO 544 Mammalogy
ZO(MEA) 549 Principles of Biological Oceanography
ZO(FW) 553 Principles of Wildlife Science
ZO(FW) 554 Wildlife Field Studies
ZO 581 Helminthology
ZO(ENT) 582 Medical and Veterinary Entomology
ZO(FW) 586 Aquaculture I
ZO(FW) 587 Aquaculture I Laboratory
ZO 588 Neurobiology
ZO 590 Special Topics
ZO 592 Topical Problems
ZO 601 Seminar
ZO(ANS,CBS,PHY) 602 Seminar in Biology of Reproduction
ZO 603 Aquatic Ecology Seminar
ZO 624 Topical Problems
ZO 631 Special Studies
ZO 660 Population Ecology
ZO 685 Master's Supervised Teaching
ZO 688 Non-Thesis Master's Continuous Registration - Half-Time Registration
ZO 689 Non-Thesis Master's Continuous Registration - Full-Time Registration
ZO 690 Master's Examination
ZO 693 Master's Supervised Research
ZO 695 Master's Thesis Research
ZO 696 Summer Thesis Research

ZO 699 Master's Thesis Preparation
ZO(ST) 710 Sampling Animal Populations
ZO 714 Advanced Cell Biology
ZO 718 Community Ecology
ZO 721 Fishery Science
ZO(FW) 726 Quantitative Fisheries Management
ZO(GN) 740 Evolutionary Genetics
ZO(MEA) 750 Marine Benthic Ecology
ZO(MEA) 754 Advances in Marine Community Ecology
ZO(MEA) 756 Ecology of Fishes
ZO(PB) 760 Principles of Ecology
ZO(PB) 770 Advanced Topics in Ecology I
ZO 784 Advanced Topics in the Study of Mammals
ZO 789 Advanced Limnology
ZO 790 Special Topics
ZO 791 Topics in Animal Behavior
ZO 792 Topical Problems
ZO(ANS,CBS,PHY) 802 Seminar in Biology of Reproduction
ZO 804 Seminar in Evolutionary Biology
ZO 824 Topical Problems
ZO 831 Special Studies
ZO 885 Doctoral Supervised Teaching
ZO 890 Doctoral Preliminary Examination
ZO 893 Doctoral Supervised Research
ZO 895 Doctoral Dissertation Research
ZO 896 Summer Dissertation Research
ZO 899 Doctoral Dissertation Preparation

Agricultural Education (Certificate)

Dr. Gary E. Moore
Director of Graduate Programs
Agricultural and Extension Education
NCSU Box 7607
Phone: 919.515.1756
Email: gary_moore@ncsu.edu

The Department of Agricultural and Extension Education offers a Certificate in Agricultural Education.

Requirements: The certificate program involves completion of 15 credit hours. Students are to choose from AEE 500, 503, 521, 522, 528, 529, 535, 641, and 735.

Community College Teaching (Certificate)

Dr. Duane Akroyd
Professor
Department of Adult and Higher Education
Email: Duane_akroyd@ncsu.edu

The departments of Adult and Higher Education (AHE) and Mathematics, Science and Technology Education (MSTE) within the College of Education at North Carolina State University offer a graduate certificate program in Community College Teaching. The program focuses on developing the knowledge and skills necessary to design and deliver course-related content through technology-enhanced learning environments for faculty who teach (or wish to teach) in community college settings. The courses developed for the graduate certificate will enhance faculty abilities in both online and traditional classroom environments. The key goal for the online Graduate Certificate Program in Community College Teaching is to provide high quality content and instruction for the systematic development of instructional expertise for regional community college instructors.

Curriculum. The Graduate Certificate Program in Community College Teaching consists of 15 semester hours of coursework. The sequence of the program is displayed in the Curriculum Flowchart . The courses are listed below.

Courses (15 credit hours):
EAC 538 Instructional Strategies in Adult and Community College Education
EAC 539 Teaching in the Online Environment
EAC 559 The Adult Learner
EAC 580 Designing Instructional Systems in Training and Development
EAC 595 Special Topics: Classroom Assessment and Evaluation

For more information about the program and for application procedures, please see the CCTeach Online website.

Design and Analysis of Environmental Systems: Watershed Assessment and Restoration (Certificate)

Dr. John Classen, Coordinator
Department of Biological and Agricultural Engineering
NCSU Box 7625
Phone: 919.515.6800
Fax: 919.515.7760
Email: gradcert-bae@ncsu.edu

The Department of Biological and Agricultural Engineering offers a Graduate Certificate Program in Design and Analysis of Environmental Systems: Watershed Assessment and Restoration.

Objectives

1. Provide a focus and formal program for students from many disciplines to pursue training in the technical and engineering aspects of designing and analyzing environmental systems with an emphasis on the watershed-scale.
2. Provide students the opportunity to develop a solid foundation in engineering systems targeted at environmental issues, particularly related to non-point sources and their impact on water quality at the watershed-scale.
3. Provide practicing engineers and other professionals a source of graduate level engineering education in the environmental field.

Admission Requirements: Applicants must have successfully completed an accredited undergraduate engineering program with a GPA of 3.0 (based on a 4.0 scale), or with an overall undergraduate GPA of at least 2.8 coupled with a 3.0 or higher in the undergraduate major, or be currently enrolled in a graduate engineering program. Applicants with a four-year undergraduate science degree who have successfully completed (with a C or better) calculus, differential equations, physics and chemistry will also be considered. A program that includes fluid mechanics or hydraulics is highly recommended. Environmental professionals who do not meet the above criteria may also qualify if appropriate experience can be demonstrated.

Program Requirements: A minimum of 12 hours of coursework selected from the list below. One course can be selected from outside of BAE (up to 2 credit hours), but at least 9 credit hours must be BAE courses.

At least 9 hours from the following:
BAE 502 Instrumentation for Hydrologic Applications
BAE 535 Precision Agriculture Technology
BAE 573 Hydrologic and Water Quality Modeling
BAE 575 Design of Structural Stormwater Best Management Practices
BAE 576 Watershed Monitoring and Assessment
BAE 577 Introduction to the Total Maximum Daily Load Program
BAE 578 Agricultural Waste Management
BAE 579 Stream Channel Assessment and Restoration
BAE 590Y Special Problems: Ecohydraulics and River Corridor Function
BAE 590I Special Problems: Open Channel Hydraulics for Natural Systems
BAE 771 Theory of Drainage – Saturated Flow
BAE 774 Theory of Drainage – Unsaturated Flow

Up to 3 credit hours can be selected from the following:
CE 580 Flow in Open Channels
CE 584 Hydraulics of Groundwater
CE 586 Engineering Hydrology
CE 775 Modeling and Analysis of Environmental Systems
CE 776 Advanced Water Management Systems
CE 784 Ground Water Contaminant Transport

CE 785 Urban Stormwater Management
SSC 511 Soil Physics
SSC 562 Environmental Applications of Soils
SSC 570 Wetland Soils

Other Information: BAE 570 (Soil Water Movement) is a general prerequisite for the program, however students who complete SSC 511 (Soil Physics) or an equivalent course with a C or better, will be considered to have met the prerequisite.

Geographic Information Systems (Minor Program/Certificate Program)

Dr. Hugh A. Devine, Coordinator
NCSU Box 7106
Phone: (919) 515-3682
Email: hugh_devine@ncsu.edu

GRADUATE FACULTY

Professors: H. A. Devine, G. D. Garson, M. L. Gumpertz, J. E. Hummer, S. Khorram, J. E. Parsons, W. J. Rasdorf, A. R. Rice, J. A. Rice, W. E. Snyder, A. B. Stein, H. J. Trussell; ***Associate Professors:*** M. L. Alibrandi, H. Cheshire, D. A. Crouse, M. Fuentes, C. G. Healey, R. W. Heiniger, G. R. Hess, M. M. Kimberley, H. Krim, J. F. Levine, S. C. Lilley, M. F. Overton, S. R. Raval, G. T. Roberson, W. R. Smith, R. A. St. Amant, J. R. Stone, M. L. Vasu; ***Research Associate Professor:*** P. K. Baran; H. S. Stubbs; ***Visiting Associate Professor:*** M. G. Genton; ***Adjunct Associate Professors:*** M. R. Loomis, H. Mitasova; ***Assistant Professors:*** L. A. Annetta, B. Bullock, M. G. Burton, Y.-F. Leung, S. A. C. Nelson, J. G. White, S. B. Wiley; ***Adjunct Assistant Professor:*** J. Fels

Geographic Information Systems (GIS) is the study of spatial distributions and relationships through the analysis and display of spatial data. The objectives of the GIS minor and certificate programs include an internationally recognized graduate GIS instruction program, addressing the high demand for professional GIS analysts and providing a focus for expanding the university's GIS research program. Currently, approximately 30 NC State graduate departments are active in varying applications of spatial analysis within their respective fields. The certificate program consists of a minimum of 15 credit hours, and the minor is 10 credit hours. The certificate program is open to both degree seeking and non-degree seeking students at the graduate level.

GRADUATE COURSES

The Graduate Minor in GIS consists of a minimum of 10 credits hours as follows:

REQUIRED COURSES

One of the following introductory GIS courses:

ECI 496 Special Topics (GIS in Education) ***OR***
ECI 630 Independent Study (GIS in Education)

PA 541 GIS for Public Administration
SSC 440 GIS in Production Agriculture
NR 531 Introduction to Geographic Information Science

FOR 510 Introduction to GPS
NR 532 Principles of Geographic Information Science
NR 533 Application Issues in GIS ***OR*** 3 credits from the following*:

BAE(SSC) 535 Precision Agriculture Technology
CE 538 Information Technology and Modeling
FOR 554 Principles of Spatial Analysis
FOR 753 Environmental Remote Sensing
LAR 500 Landscape Design Studio (GIS section)
NR 535 Computer Cartography
ST 733 Applied Spatial Statistics

*Student must take NR 533 or demonstrate a suitable project experience approved by the GIS Faculty Coordinator or his or her minor representative.

The Graduate Certificate in GIS consists of a minimum of 15 credits hours, 10 credit hours of required courses and 5 credit hours of elective courses, as follows:

REQUIRED COURSES (10 credit hours)

One of the following introductory GIS courses:

ECI 496 Special Topics (GIS in Education) ***OR***
ECI 630 Independent Study (GIS in Education)

PA 541 GIS for Public Administration
SSC 440 GIS in Production Agriculture
NR 531 Introduction to Geographic Information Science

FOR 510 Introduction to GPS
NR 532 Principles of Geographic Information Science
NR 533 Application Issues in GIS

ELECTIVES (5 credit hours)

BAE(SSC) 535 Precision Agriculture Technology
CE 538 Information Technology and Modeling
FOR 554 Principles of Spatial Analysis
FOR 753 Environmental Remote Sensing
LAR 500 Landscape Design Studio (GIS section)
NR 535 Computer Cartography
SSC 590 Special Problems (Remote Sensing Applications in Soil Science & Agriculture)
ST 733 Applied Spatial Statistics

Horticultural Science (Certificate Program)

Dr. John M. Dole, Director of Graduate Programs
Department of Horticultural Science
Phone: 919.515.3537
FAX: 919.515.7747
Email: john_dole@ncsu.edu

The Certificate in Horticultural Science is a non-degree program offered through the Department of Horticultural Science at North Carolina State University. The Certificate program is designed to increase personal knowledge and skills for current or future employment in the Horticultural Industry. Students may concentrate in one of three areas: General Horticulture, Food Horticulture and Ornamental Horticulture.

Requirements: The Certificate program requires a minimum of five courses resulting in at least 15 credits to be completed within 4 years. The courses will constitute a cohesive continuing education in Horticultural Science and will be selected by the candidate and the advisor.

Applicant must have a B.S. or higher degree from an accredited four-year college or university and have a GPA of at least 3.0 on a 4.0-point scale.

It is highly recommended that candidates have a major in horticulture, crop science, plant science, plant biology or agricultural education with a plant science emphasis. Applicants who do not meet the GPA requirement may be admitted provisionally based on past work experience as a professional in horticulture or a related field. Supporting documentation of professional experience in horticulture or a related field must be submitted for provisional admission. Students who are admitted provisionally must earn at least a 3.0 GPA average in the first two courses of the certificate program in order to obtain full admission into the program. Certificate students must maintain an average GPA of 3.0 and a minimum grade of C (2.00) in any of the Horticulture Graduate Certificate courses.

Curriculum: The following courses can be used for credit in the Horticultural Science Certificate Program.

Horticultural Science
HS 542 Advanced Vegetable Crop Management
HS 551 Hort. Crops Nutrition
HS 562 Post Harvest Physiology
HS 590 Special Problems in Horticultural Science (Greenhouse Food Prod)
HS 590 Special Problems in Horticultural Science (Small Fruit Management)
HS 590 Special Problems in Horticultural Science (Nursery Crop Management)
HS(CS) 717 Weed Management Systems

Any other graduate-level Horticultural Science courses.

Plant Pathology
HS 502 Plant Disease: Methods/Diagnosis

Entomology
ENT 591 Insect Pest Management
ENT 690 Horticultural Entomology

Soil Science
SSC 440 Geographic Information
SSC 470/570 Wetland Soils
SSC 532 Soil Microbiology
SSC 551 Soil Morphology, Genesis and Classification
SSC 562 Environmental Applications of Soil Science

Food Science
FS 495 Special Topics in Food Science (Good Manufacturing Practices)
FS 495 Special Topics in Food Science (Sanitation Standard Opt. Proc.)
FS 495 Special Topics in Food Science (Sanitation)
FS 495 Special Topics in Food Science (Hazard Analysis/ Risk Assess.)
FS 495 Special Topics in Food Science (Microbiology / Microbial Hazards)

Agriculture & Extension Education
AEE 501 Foundations of Agriculture & Extension Education
AEE 521 Program Planning in Agriculture & Extension Education
AEE 523 Adult Education in Agriculture

For more information about the Certificate Program and applications materials, please see the Department of Horticultural Science website.

Molecular Biotechnology (Certificate Program)

Dr. Susan Carson, Coordinator
NCSU Box 7512
Phone: 919.513.0330
Email: sue_carson@ncsu.edu
Website: http://www.ncsu.edu/biotechnology/

Training in molecular biotechnology is essential for an expanding list of disciplines that have found modern biology-based skills of critical importance in pursuing research goals in areas ranging from microbiology to plant and animal sciences to chemical engineering. The Graduate Certificate Program in Molecular Biotechnology offers an opportunity for individuals educated in the life sciences and related disciplines to gain laboratory-based, hands-on training in many aspects of molecular biotechnology. While this Certificate Program is geared primarily toward non-traditional students who have already entered the workforce, NCSU graduate students with career interests that involve molecular biotechnology are also eligible to apply. Admissions requirements can be viewed at the program website.

The Graduate Certificate Program in Molecular Biotechnology will require a minimum of 12 hours of required and elective courses as listed below:

REQUIRED (5 credits)

BIT 510 and BIT 510L Core Technologies in Molecular and Cellular Biotechnology (4 credits)
BIT 595C Issues in Biotechnology (1 credit) or an approved research ethics or bioethics course

BIOTECHNOLOGY LABORATORY ELECTIVES (4 credits)
Two of the following courses and their laboratories (2 credits each):

BIT 562 Microarrays
BIT 563 Fermentation
BIT 564 Protein Purification
BIT 565 Real-time PCR Techniques
BIT 566 Animal Cell Culture
BIT 567 PCR and DNA Fingerprinting
BIT 568 Genome Mapping
BIT 569 RNA Purification and Analysis
BIT 581 Plant Transformation and Tissue Culture
Other BIT laboratory courses (2 credits) by permission

OTHER ELECTIVES -- CHOOSE ONE (3 credits)

GN 411 Principles of Genetics
GN 513 Advanced Genetics
MB 714 Microbial Metabolic Regulation
MB(GN) 758 Prokaryotic Molecular Genetics
BO 780 Plant Molecular Biology
BCH 553 Biochemistry of Gene Expression
FS(MB) 725 Fermentation Microbiology
ST(GN) 721 Genetic Data Analysis
GN 701 Molecular Genetics
GN 735 Functional Genomics
CHE 551 Biochemical Engineering
Other courses (400-level or higher) may be considered by special request.

Nonprofit Management (Certificate Program)

Dr. Richard Clerkin
Assistant Professor, Public Administration
School of Public and International Affairs
Department of Public Administration
NCSU Box 8102
Raleigh, NC 27695-8102
Phone: 919.515.5037
Email: rmclerki@ncsu.edu

A Graduate Certificate in Nonprofit Management is available to students, including NC State degree students, who have a Bachelor's degree from an accredited university. The Certificate requires 15 credit hours of course work. The courses are designed to provide the basic management knowledge and skills needed in nonprofit organizations. For applications and a description of program requirements go to http://www.chass.ncsu.edu/pa/certificateNonProfit.htm

Nonwovens Science and Technology

Dr. George L. Hodge
Director of Graduate Programs
Department of Textile and Apparel, Technology, and Management
Phone: (919) 515-6579
Email: george_hodge@ncsu.edu

The certificate program in Nonwovens Science and Techology provides NC State graduate students the opportunity to develop recognized academic credentials in Nonwovens Science and Technology in addition to their major area of graduate study. Provide non-degree graduate level students the opportunity to develop recognized advanced expertise in Nonwovens Science and Technology.

Required Coursework: The Graduate Certificate Program in Nonwovens Science and Technology requires a minimum of 15 hours and includes the following courses:

Core Courses (6 hours):
- TT 503 Materials, Polymers and Fibers Used in Nonwovens (3 hours)
- TT 504 Introduction to Nonwovens Products and Processes (3 hours)

Advanced Courses (minimum 9 hours)*:
- TT 505 Advanced Nonwovens Processing (3 hours)
- TT 506 Bonding Principles in Nonwovens (3 hours)
- TT 507 Nonwoven Characterization Methods (3 hours)
- TT 508 Nonwoven Product Development (3 hours)

*One NC State course (400-level or higher) may be substituted for one of the advanced courses into the program upon agreement between the Certificate Coordinator and the student. The Certificate Coordinator will maintain a list of appropriate level graduate courses.

Program Development in Family Life Education (Certificate Program)

Dr. Karen DeBord
Department of Family and Consumer Sciences
NCSU Box 7605
Phone: 515.9147
Email: karen_debord@ncsu.edu
Website: www.ces.ncsu.edu/depts/4hfcs/academics/cert/

A Graduate Certificate in Program Development in Family Life Education requires a total of 12 credit hours. Nine credit hours are required courses, with the remaining three credit hours of electives.

Required Courses

FCS 510 Program Development and Evaluation of Family Life Education Programs (3)
FCS 512 Family and Community Partnerships (3)
FCS 522 Family Life Education (3)

Electives (minimum of three hours)

FCS 523 Family Relationships Across the Lifespan (3)
FCS 524 Applications of Gerontology to Family Life Education (3)
FCS 531 Effective Management of Family Resources (3)
FCS 540 Influence of Environments on the Family (3)
FCS 595 Contemporary Issues in Family Life Education (1)

Training and Development

Dr. Timothy Hatcher
Associate Professor and Coordinator
Department of Adult and Higher Education
Phone: 919.515.6246
FAX: 919.515.4039
Email: tim_hatcher@ncsu.edu

The Certificate in Training and Development is a non-degree program for lifelong learning students offered through the Department of Adult and Higher Education at North Carolina State University. Lifelong learning students are those students who are classified by the University as PBS (Post-baccalaureate Studies) for purposes of registration.

The Certificate program consists of a selected set of for-credit courses that are offered in an online format. The courses are selected to offer a cohesive continuing education opportunity for people in training roles in business and industry. This program is designed for the person who has recently advanced into a training position and is without the academic preparation needed or for those choosing to increase their knowledge and skills in training for current or future jobs. The program is not intended for career exploration nor is it a prerequisite for or part of a graduate degree program. The program is made up of a minimum of five 3-credit courses. The student will complete the identified Certificate courses through continuous enrollment (excluding summer sessions) until contract requirements are met. Participants must hold a baccalaureate degree to enroll in the Certificate Program.

Curriculum: The program requires completion on the following five courses.

EAC 580 Designing Instructional Systems in Training and Development
EAC 583 Needs Assessment and Task Analysis in Training and Development
EAC 584 Evaluating Training Transfer and Effectiveness
EAC 586 Methods and Techniques of Training and Development
EAC 759 The Adult Learner

Additional NC State courses can be incorporated into the program upon agreement between the program coordinator and the student. For course descriptions, please refer to the NCSU listing of courses.

Other Information: All graduate students are expected to either pass the AHE technology competencies through a testing out procedure or to attend a workshop at the beginning of their studies.

For further information, see the Certificate in Training and Development website or the Adult and Higher Education website.

Geographic Information Systems (Minor Program/Certificate Program)

Dr. Hugh A. Devine, Coordinator
NCSU Box 7106
Phone: (919) 515-3682
Email: hugh_devine@ncsu.edu

GRADUATE FACULTY

Professors: H. A. Devine, G. D. Garson, M. L. Gumpertz, J. E. Hummer, S. Khorram, J. E. Parsons, W. J. Rasdorf, A. R. Rice, J. A. Rice, W. E. Snyder, A. B. Stein, H. J. Trussell; ***Associate Professors:*** M. L. Alibrandi, H. Cheshire, D. A. Crouse, M. Fuentes, C. G. Healey, R. W. Heiniger, G. R. Hess, M. M. Kimberley, H. Krim, J. F. Levine, S. C. Lilley, M. F. Overton, S. R. Raval, G. T. Roberson, W. R. Smith, R. A. St. Amant, J. R. Stone, M. L. Vasu; ***Research Associate Professor:*** P. K. Baran; H. S. Stubbs; ***Visiting Associate Professor:*** M. G. Genton; ***Adjunct Associate Professors:*** M. R. Loomis, H. Mitasova; ***Assistant Professors:*** L. A. Annetta, B. Bullock, M. G. Burton, Y.-F. Leung, S. A. C. Nelson, J. G. White, S. B. Wiley; ***Adjunct Assistant Professor:*** J. Fels

Geographic Information Systems (GIS) is the study of spatial distributions and relationships through the analysis and display of spatial data. The objectives of the GIS minor and certificate programs include an internationally recognized graduate GIS instruction program, addressing the high demand for professional GIS analysts and providing a focus for expanding the university's GIS research program. Currently, approximately 30 NC State graduate departments are active in varying applications of spatial analysis within their respective fields. The certificate program consists of a minimum of 15 credit hours, and the minor is 10 credit hours. The certificate program is open to both degree seeking and non-degree seeking students at the graduate level.

GRADUATE COURSES

The Graduate Minor in GIS consists of a minimum of 10 credits hours as follows:

REQUIRED COURSES

One of the following introductory GIS courses:

ECI 496 Special Topics (GIS in Education) ***OR***
ECI 630 Independent Study (GIS in Education)

PA 541 GIS for Public Administration
SSC 440 GIS in Production Agriculture
NR 531 Introduction to Geographic Information Science

FOR 510 Introduction to GPS
NR 532 Principles of Geographic Information Science
NR 533 Application Issues in GIS ***OR*** 3 credits from the following*:

BAE(SSC) 535 Precision Agriculture Technology
CE 538 Information Technology and Modeling
FOR 554 Principles of Spatial Analysis
FOR 753 Environmental Remote Sensing
LAR 500 Landscape Design Studio (GIS section)
NR 535 Computer Cartography
ST 733 Applied Spatial Statistics

*Student must take NR 533 or demonstrate a suitable project experience approved by the GIS Faculty Coordinator or his or her minor representative.

The Graduate Certificate in GIS consists of a minimum of 15 credits hours, 10 credit hours of required courses and 5 credit hours of elective courses, as follows:

REQUIRED COURSES (10 credit hours)

One of the following introductory GIS courses:

ECI 496 Special Topics (GIS in Education) ***OR***
ECI 630 Independent Study (GIS in Education)

PA 541 GIS for Public Administration
SSC 440 GIS in Production Agriculture
NR 531 Introduction to Geographic Information Science

FOR 510 Introduction to GPS
NR 532 Principles of Geographic Information Science
NR 533 Application Issues in GIS

ELECTIVES (5 credit hours)

BAE(SSC) 535 Precision Agriculture Technology
CE 538 Information Technology and Modeling
FOR 554 Principles of Spatial Analysis
FOR 753 Environmental Remote Sensing
LAR 500 Landscape Design Studio (GIS section)
NR 535 Computer Cartography
SSC 590 Special Problems (Remote Sensing Applications in Soil Science & Agriculture)
ST 733 Applied Spatial Statistics

Artificial Intelligence (Minor Program)

GRADUATE FACULTY

Professors: J. Doyle, R. C. Luo, W. J. Rasdorf, R. D. Rodman, H. E. Schaffer, M. White; ***Associate Professors:*** D. R. Bahler, J. Lester, H. D. Levin, E. T. Sanii, M. Singh, R. St. Amant; ***Assistant Professors:*** C. Healey, P. Wurman, R. M. Young; ***Lecturer:*** J. C. Sutton III

Artificial intelligence is the branch of computer science concerned with designing computer systems that exhibit characteristics normally associated with intelligence in human behavior, such as understanding language, learning, reasoning, and solving problems. At NC State, artificial intelligence is an interdisciplinary field, with faculty from several departments engaged in fundamental research and applications.

The university offers courses of study leading to a minor in artificial intelligence as part of the M.S. and Ph.D. degrees. This option is available to all graduate students except those in computer science, who can choose artificial intelligence as an interest area.

To fulfill the academic requirements for a minor in artificial intelligence, each master's student must successfully complete at least three, and each doctoral student at least six, of the courses in the artificial intelligence curriculum. Two of the courses must be CSC 520, Artificial Intelligence I and CSC 720, Artificial Intelligence II. Other courses offered as part of the artificial intelligence curriculum include: CSC 523 Computational Linguistics; CSC 723 Computational Semantics; ECE 763 Computer Vision; CSC(IE) 556 Voice Input/Output Communication Systems; CSC(IE) 756 Advances in Voice Input/Output Communication Systems. Also, from time to time special topics courses are offered covering subjects such as knowledge engineering, fuzzy reasoning, knowledge representation, neural networks, machine learning, artificial intelligence applications to CAD, and artificial intelligence in manufacturing.

Graduate students in computer science who select artificial intelligence as an interest area are subject to the same academic requirements that define other interest areas within computer science.

Biotechnology (Minor Program)

Professor R. M. Kelly, Director
Box 7512
919.515.4230
919.515.4231 (fax)
Email: biotech@ncsu.edu

Dr. Sue Carson, Academic Coordinator
919.513.0330
Email: sue_carson@ncsu.edu
Home page: http://www.ncsu.edu/biotechnology/

The Biotechnology Program includes faculty from at least twenty departments in the Colleges of Agriculture and Life Sciences, Engineering, Natural Resources, Physical and Mathematical Sciences, and Veterinary Medicine. Graduate study leading to either an M.S. minor or a Ph.D. minor in biotechnology may be taken by students who reside and conduct their research in one of the participating departments. To obtain a minor in biotechnology, the student must successfully complete at least six credit hours in the laboratory core courses selected from the list below and must conduct graduate thesis research in an area of biotechnology.

Research in biotechnology is focused in three main areas: recombinant DNA technology, bioprocessing/bioanalytical techniques, and *in vitro* culture techniques. The multidisciplinary nature of biotechnology means that a wide range of research topics and techniques are applicable, such as molecular genetics and associated research in molecular biology, fermentation and protein purification, cell culture techniques, and microarray technology.

See the biotechnology home page for a current listing of faculty.

GRADUATE COURSES

BIT 510 Core Technologies in Molecular and Cellular Biology
BIT 562 Gene Expression: Microarrays
BIT(CHE) 563 Fermentation of Recombinant Microorganisms
BIT 564 Protein Purification
BIT 565 Real-time PCR Techniques
BIT(PO) 566 Animal Cell Culture Techniques
BIT 567 PCR and DNA Fingerprinting
BIT 568 Genome Mapping
BIT 569 RNA Purification and Analysis
BIT(PB) 581 Plant Tissue Culture and Transformation
BIT 595 Special Topics
BIT 815 Advanced Special Topics

Cognitive Science (Minor Program)

Dr. Ronald P. Endicott, Program Director
Department of Philosophy and Religion
NCSU Box 8103
Phone: (919) 515-6195
Email: ron_endicott@ncsu.edu

Cognitive Science is an area of interdisciplinary research that seeks to understand the nature, processes, and evolution of mind. The Cognitive Science Program is administered by the Department of Philosophy and Religion and supported by a strong faculty drawn from the fields of Psychology, Neurobiology, Computer Science, Linguistics, and Philosophy. The program thus fosters development of ideas and theories within the disciplines of Cognitive Science, for example, theories of rational agency, logical reasoning, cognitive processing, computational psychology, artificial intelligence, neurobiology, and the evolution of cognitive systems.

Requirements: Graduate students who minor in Cognitive Science must complete a minimum of nine hours of courses (or more as determined by the student's committee), with a grade of B or better, distributed as follows.

One core courses (3 hrs):

PHI/PSY 525 Introduction to Cognitive Science

Two additional courses (6 hrs) outside the degree-granting program from the following:

PSY 500 Visual Perception
PSY 502 Physiological Psychology
PSY 508 Cognitive Processes
PHI 540 The Scientific Method
CSC 520 Artificial Intelligence I
CSC 522 Automated Learning and Data Analysis
CSC 523 Computational Linguistics
CSC 707 Automata, Languages and Computability Theory
CSC 720 Artificial Intelligence II
ENG 524 Introduction to Linguistics
ENG 584 Studies in Linguistics
ZO 588 Neurobiology

Any student who has previously completed the equivalent of the above core course for credit toward another degree (e.g., PHI/PSY 425 as an undergraduate) is required to complete an additional course (3 hours) from the above list.

Up to three credits of equivalent graduate course work may be accepted in the place of one course on the list above, subject to the approval of the Director for the Cognitive Science Program.

Computational Engineering and Sciences (Minor Program)

GRADUATE FACULTY

Professor P. J. Turinsky, Program Coordinator

Camille Dreyfus Professor: C. K. Hall
Graduate Alumni Distinguished Professor: G. E. Mitchell
University Professor and Drexel Professor: H. T. Banks

Professors: W. E. Alexander, J. W. Baugh, J. Bernholc, D. W. Brenner, T. M. Conte, S. R. Cotanch, J. E. Franke, R. E. Funderlic, C. Kleinstreuer, C. R. Ji, Y.-L. Lin, D. F. McAllister, D. S. McRae, T. K. Miller III, J. F. Monahan, H. G. Perros, R. O. Scattergood, W. J. Stewart, M. A. Vouk, M. H. Whangbo, R. E. White, J. L. Whitten; ***Associate Professors:*** J. M. Doster, E. F. Gehringer; ***Assistant Professor:*** G. Mahinthakumar

The Computational Engineering and Sciences Program includes faculty from twelve departments in the College of Engineering and College of Physical and Mathematical Sciences. Graduate students pursuing graduate study toward a master's or Ph.D. degree in one of the participating science or engineering departments may elect this program in place of the traditional minor. [Note that students wishing to earn a graduate degree in mathematics or computer science should reference these departments' sections of the Graduate Catalog for details on options available in computational mathematics and scientific computing.] To complete the program requirements, a student must successfully complete a sequence of graduate-level applied mathematics and computer science courses and, if a research dissertation is required, utilize advanced computational techniques in the course of conducting the research.

The Computational Engineering and Sciences Program is designed to efficiently prepare graduate students to undertake research utilizing scientific computing by combining course work in applied mathematics and computer science in addition to course work in the traditional major. The program recognizes that a new area of scientific pursuit, numerical simulation, has emerged as a new paradigm for scientific inquiry complementing theory and laboratory experiment. Typical areas of research include, but are not limited to, computational fluid dynamics, quantum chemistry and atmospheric modeling. Admission to the program is gained after enrollment in the Graduate School and the graduate program is underway. Program course requirements are selected from applied mathematics and computer science courses listed elsewhere in this Graduate Catalog. Typical courses that may be selected to satisfy this program's requirements include advanced calculus, numerical analysis, numerical linear algebra for parallel architectures, stochastic simulation, computer operating systems, digital systems architecture, computer graphics, compiler construction, software engineering, and design and analysis of algorithms.

Ecology (Minor Program)

GRADUATE FACULTY

Stephen W. Broome, Coordinator
Box 7619, (919) 513-2555, Fax (919) 515-2167, E-mail: Stephen_Broome@ncsu.edu

Ecology is the science concerned with the interactions of organisms with each other and with their environment. It is an integrative science through which one gains an understanding of biological and physical interrelationships and predicts the consequences of altering one or several components. Students in a number of basic and applied curricula may elect to minor in ecology at the M. S. and Ph.D. levels. The minor provides an opportunity for a broad overview of the science of ecology.

The ecology minor is an interdepartmental program drawing faculty from the Departments of Botany, Crop Science, Entomology, Forestry, Marine, Earth and Atmospheric Sciences, Parks, Recreation and Tourism Management, Plant Pathology, Soil Science, Statistics, and Zoology. The Ecology Advisory Committee administers the program.

Requirements for a Minor in Ecology

A graduate student's advisory committee must include one member of the Ecology Advisory Committee from a department other than that of the chairman of the student's committee.

M.S. minor: at least one course must be selected from the list of Ecology Core Courses, at least two additional courses selected from the list of Approved Ecology Courses or the Core Courses, and Ecology seminar (ECO 601), totaling a minimum of 9 semester hours. Courses selected form the list of Approved Ecology Courses must be from outside the student's major discipline.

Ph.D. minor: at least one course must be selected from the list of Ecology Core Courses, at least three additional courses selected from the list of Approved Ecology Courses or the Core Courses, and Ecology seminar (ECO 601), totaling a minimum of 12 semester hours. Courses selected form the list of Approved Ecology Courses must be from outside the student's major discipline. No courses used to meet the Ecology minor requirements for the M.S. degree may be used to meet the Ph.D. minor requirements.

GRADUATE COURSES

ECO 601 Seminar
ECO 620 Special Problems

Environmental Remote Sensing and Image Analysis (Minor Program)

Dr. Siamak Khorram
Box 7106, (919) 515-2868
khorram@ncsu.edu

This graduate minor provides graduate students the opportunity to develop a recognized academic credential in remote sensing and image analysis in conjunction with their major program of graduate study. A minimum of 12 credit hours, 6 credit hours of required courses and 6 credit hours of elective courses, is required to complete the minor. Students can select coursework from the following list.

GRADUATE COURSES

REQUIRED COURSES (6 credit hours)

FOR 753 Environmental Remote Sensing
ECE 759 Pattern Recognition, **OR**
ST 733 Applied Spatial Statistics

ELECTIVES (6 credit hours)

ECE 751 Detection and Estimation Theory
ECE 758 Digital Image Processing
FOR 510 Introduction to GPS
FOR 554 Principles of Spatial Analysis
NR 531 Introduction to Geographic Information Science
NR 532 Principles of Geographic Information Science
NR 533 Application Issues in Geographic Information Systems
ST 733 Applied Spatial Statistics

Food Safety (Minor Program)

GRADUATE FACULTY

Professor Lee-Ann Jaykus, Director

Professors: B. P. Alston-Mills, K. Anderson, S. M. Blankenship, S. A. Hale, H. M. Hassan, T. J. Hoban, T. G. Isleib, L. Jaykus, T. R. Klaenhammer, J. Levine, G. Luginbuhl, W. E. M. Morrow, J. Riviere, J. Rushing, D. Shea, B. W. Sheldon, D. R. Ward; ***Associate Professors:*** R. E. Baynes, M. Correa, P. Cowen, M. A. Drake, S. Kathariou, C. E. Sorenson; ***Assistant Professors:*** J. W. Olson

The primary objective of the Food Safety Minor is to prepare science professionals with the depth and breadth of training necessary to understand and to control food safety challenges. The interdisciplinary minor includes departments in the Colleges of Agriculture and Life Sciences and Veterinary Medicine with the occasional participation of other NCSU colleges. Participating graduate students are required to have, or to develop during the early part of their training, appropriate knowledge in the basic scientific disciplines of chemistry, biochemistry and microbiology. Further, it is highly desirable that formal course training in genetics and statistics be part of each student's academic program. Students in a master's program are required to have 10 credits from the core courses to earn the food safety minor. Students in a doctoral program are required to have, as a minimum, 10 credits from the core courses.

CORE COURSES

FSA520 Pre-harvest Food Safety
FSA(FS) 530 Post-harvest Food Safety
FSA(FS) 540 Food Safety and Public Health
FSA(FS) 580 Professional Development and Ethics in Food Safety

Interdisciplinary Minor

The interdisciplinary minor requires two or more areas of coursework to be represented with a faculty member representing one of the areas of coursework.

Life Science Ethics (Minor Program)

Dr. David Auerbach, Director
Philosophy Department: 919.515.6331
Email: auerbach@unity.ncsu.edu

Primary Objectives:

- to guide graduate students in careful discussion of ethical issues in the life sciences, especially those faced by life scientists in research;
- to provide graduate students with the conceptual tools and principles needed to recognize and respond to ethical challenges in the life sciences;
- to provide graduate students in the life sciences and related areas with an opportunity to enrich scientific training with an understanding of the history and theory of ethics.

Academic Requirements: Graduate students participating in the life science ethics minor must earn at least one credit in a Responsible Conduct of Research (RCR) training course. At the present time, several RCR courses are offered on campus by departments with graduate degree programs. These include: Ethics & Professional Practice in Public Administration (PA 510); Professionalism & Ethics (GN 820E); Professional Ethics and Conduct of Science (CBS 662); Special Topics: Graduate Research Ethics (CHE 596D); Ethics and Jurisprudence (VMC 915).

Students in these degree programs may take an RCR course offered by faculty in the department that grants their degree. Students from any graduate degree program may choose instead to fulfill the RCR requirement for the minor with Introduction to Research Ethics (PHI 816).

In addition to the RCR requirement, students must also complete the following nine graduate credits in philosophy with a grade of B- or better: Life-Science Ethics (PHI 515); Philosophical Issues in Environmental Ethics (PHI 522); The Scientific Method (PHI 540).

Application to Minor Program: Prospective students must apply to and meet all admission requirements of a graduate degree program (and be members in good standing of that program), and must declare their intention to minor by completing a form available in the Department of Philosophy and Religion.

Plant Physiology

GRADUATE FACULTY

Professor T. W. Rufty Jr., Coordinator
NCSU Box 7620
919.515.3660

Professors*:* N.S. Allen, S.M. Blankenship, W.F. Boss, R.S. Boston, S.D. Clouse, R.E. Dewey, J. Huang, M.M. Peet, T.G. Ranney, D Robertson; E.C. Sisler, S.L. Spiker, W.F. Thompson, R.Wells; **Professors (USDA):** E.L. Fiscus, D.W. Israel; **Associate Professors:** H.V. Amerson, D.C. Bowman, J.D. Burton, R. Whetten; **Associate Professors (USDA):** K.O. Burkey, D.P. Livingston; **Research Associate Professor:** J.D. Williamson

The plant physiology program is an interdepartmental offering. Although not a formal degree program, students may elect to major or minor in the plant physiology program at both the M.S. and Ph.D. levels. Students entering the program should have appropriate knowledge in plant biology, biochemistry, mathematics and physics. Some formal training in genetics and statistics is normally expected.

When majoring in plant physiology, students will be closely affiliated with the same department as their major professor. As such, they will be required to meet respective departmental requirements for teaching, written and oral examinations, and seminar attendance. Departments currently participating in this program are: Biochemistry, Botany, Crop Science, Forestry, Genetics, Horticultural Science, Plant Pathology, and Soil Science. The chair or co-chair of the student's advisory committee must be a member of the Plant Physiology Faculty.

The purpose of the plant physiology curriculum is to ensure that students obtain substantive understanding of the physiological processes controlling plant behavior. The course requirements for graduate students are set by each graduate committee. Advanced knowledge is expected in biochemistry, plant physiology, plant structure and function, and molecular biology.

The program is administered by the Plant Physiology Executive Committee. Additional information about the program may be obtained by writing to one of the listed faculty members or to the coordinator.

Solid State Sciences (Minor Program)

GRADUATE FACULTY

University Professor G. Lucovsky, Chair

Professors: D. E. Aspnes, K. J. Bachmann, S. M. Bedair, J. Bernholc, R. F. Davis, R. E. Fornes, J. R. Hauser, J. J. Hren, M. A. Littlejohn, R. M. Kolbas, J. Narayan, R. J. Nemanich, M. A. Paesler, G. Rozgonyi, P. E. Russell, J. F. Schetzina, A. F. Schreiner, E. O. Stejskal, M. H. Whangbo, J. J. Wortman

The university offers courses of study leading to a minor in solid state sciences as part of the M.S. and the Ph.D. degrees. This option is available to all graduate students pursuing research in the broad area of solid state science and requires that a member of the solid state sciences faculty serve on the student's research committee.

Solid state sciences is an interdisciplinary area of research that applies and extends concepts from the traditional academic disciplines of chemistry, electrical and computer engineering, materials science and engineering, and physics to basic and applied problems with a primary focus on solid state materials. At NC State, there are a significant number of such research programs that involve faculty and students in more than one of the academic departments listed above. This minor program can be customized to provide a course complement for these ongoing programs, as well as for any additional solid state materials research programs as they are initiated, developed and implemented.

To fulfill the academic requirements for a minor in solid state sciences, each master's student must successfully complete at least three, and each doctoral student, four of the courses in the solid states sciences curriculum. A partial listing of courses in this program includes: CH 701, 703 Advanced Inorganic Chemistry I, II; CH 731 Chemical Thermodynamics; CH 733 Chemical Kinetics; CH 737 Quantum Chemistry; ECE 730 Physical Electronics; ECE 739 Integrated Circuit Technology and Fabrication; ECE 723 Optical Properties of Semiconductors; ECE 724 Electronic Properties of Solid State Devices; ECE (PY) 727 Semiconductor Thin Films Technology; MAT 712 Scanning Electron Microscopy; MAT 715 Fundamentals of Transmission Electron Microscopy; MAT 560 Materials Science and Processing of Semiconductor Devices; MAT 795 Advanced Materials Experiments; MAT 722 Advanced Scanning Electron Microscopy and Surface Analysis; MAT 770 Defects, Diffusion and Ion Implantation in Semiconductors; MAT 792 Advanced Topics in Materials Science and Engineering; PY (ECE) 552 Introduction to the Structure of Solids. In addition, other courses (for example, special topics courses in any one of the participating departments) may also be substituted into an individual student's designated solid state sciences minor program at the discretion of his/her committee.

Water Resources (Minor Program)

J. D. Gregory, Chair
NCSU Box 8008
919.515;7567
E-mail: jim_gregory@ncsu.edu

WATER RESOURCES COMMITTEE

D. J. Phaneuf (Agricultural and Resource Economics), J. M. Burkholder (Botany), M. R. Overcash (Chemical Engineering), R. C. Borden (Civil Engineering), J. B. Weber (Crop Science), R. B. Palmquist (Economics), F. P. Hain (Entomology), W. G. Cope (Environmental and Molecular Toxicology), K. M. Keener (Food Science), A. B. Stein (Landscape Architecture), D. Genereux (Marine, Earth and Atmospheric Sciences), J. W. Gilliam (Soil Science), C. B. Smith (Textile Engineering, Chemistry and Science), J. F. Gilliam (Zoology)

The interdisciplinary, interdepartmental graduate minor in water resources is designed for students majoring in the many disciplines of natural resources, science, engineering, technology, and social sciences that are relevant to water resources. The minor exposes students to water resources courses and faculty members outside their major fields of study.

A graduate student may enroll in the water resources minor by including it on the plan of graduate work and sending that plan of work to J. D. Gregory for review. A graduate faculty member from outside the student's major department or program must be appointed to serve as the minor representative on his/her advisory committee. The minor representative may be a member of the Water Resources Committee or another faculty member from a department represented on the Water Resources Committee who is active in teaching/research related to water resources.

Master's Degree: Minimum course requirements for the minor are three courses (minimum of eight credit hours) from water resources areas outside the student's major field of study approved by the student's minor representative.

Doctor of Philosophy Degree: Minimum course requirements for the minor are three courses (minimum of eight credit hours) from water resources areas outside the student's major field of study approved by the student's minor representative. These courses shall be in addition to those previously taken at the Master's level when that degree included a Water Resources Minor.

A course in the legal, institutional, or economic aspects of water resources is recommended for each minor program. Suggested courses are listed below; other appropriate courses may be included in the minor. Contact J. D. Gregory for additional information.

WATER RESOURCES COURSES

Legal, Institutional and Economic Aspects of Water Resources
EC(ARE) 436 Environmental Economics
ECG 515 Environmental and Resource Policy
ET 450 Environmental Regulation
FOR 460 Renewable Resource Policy and Management
NR 571 Current Issues in Natural Resource Policy
PA 550 Environmental Policy

Planning of Water Resources and Related Systems
ET 460 Practice of Environmental Technology
NR 484 Environmental Impact Assessment.
LAR 430 Site Planning
LAR 512 Landscape Resource Management

Municipal and Industrial Water Management
CE 484 Water Supply and Waste Water Systems
CE 571 Physical Principles of Environmental Engineering
CE 574 Chemical Principles of Environmental Engineering
CHE 575 Advances in Pollution Prevention: Environmental Management
TAM(PCC) 401 Environmental Aspects of the Textile Industry
WPS 725 Pollution Abatement in Forest Products Industries
WPS 750 Wastewater Treatment in the Paper Industry

Agricultural and Forest Water Management
BAE 471 Land Resources Enviromental Engineering
BAE 472/572 Irrigation and Drainage
BAE(CE) 578 Agricultural Waste Management
CS(HS,SSC,TOX) 725 Pesticide Chemistry
CS(HS,SSC,TOX) 727 Pesticide Behavior and Fate in the Environment
SSC 461 Soil Physical Properties and Plant Growth
SSC 511 Soil Physics
SSC 562 Environmental Applications of Soil Science

Biological and Ecological Aspects of Water Resources
BO(ZO) 760 Principles of Ecology
BO(MB) 774 Phycology
FW(ZO) 420 Fishery Science
FW(ZO) 586 Aquaculture I
FW(ZO) 587 Aquaculture I Laboratory
MEA(ZO) 549 Principles of Biological Oceanography
ZO 441 Biology of Fishes
ZO 519 Limnology
ZO 789 Advanced Limnology

Hydrologic, Meteorologic, Oceanographic, and Water Quality Aspects of Water Resources
BAE 473 Introduction to Surface/Water Quality Modeling
BAE 502 Instrumentation for Hydrologic Applications
BAE 570 Soil Water Movement
BAE(SSC) 573 Hydrologic and Water Quality Modeling.
BAE 575 Design of Structural Stormwater Best Management Practices.
BAE 576 Watershed Monitoring and Assessment.
BAE 577 Introduction to the Total Maximum Daily Load Program.
BAE 579 Stream Channel Assessment and Rstoration
BAE(SSC)771 Theory of Drainage-Saturated Flow
BAE(SSC) 774 Theory of Drainage-Unsaturated Flow
CE 583 Engineering Aspects of Coastal Processes
CE 584 Hydraulics of Ground Water
CE 586 Engineering Hydrology
CE 607 Water Resource and Environmental Engineering Seminar
FOR(NR) 420/520 Watershed and Wetlands Hydrology
MEA 455 Micrometeorology
MEA 481 Principles of Geomorphology
MEA 540 Principles of Physical Oceanography
MEA 560 Chemical Oceanography
MEA 585 Hydrogeology
MEA 706 Meteorology of the Biosphere
MEA 760 Biogeochemistry
MEA 785 Chemical Hydrogeology
SSC(BAE) 780 Transport and Fate of Chemicals in Soils and Natural Waters

Wetlands
NR 521 Wetland Assessment, Delineation, and Regulation
SSC 570 Wetland Soils

Women's and Gender Studies (Minor Program)

GRADUATE FACULTY

Dr. C. A. Warren, Director

Professors: N. S. Allen, C. Gross, A. G. Halberstadt, A. H. Harrison, K. Luria, M. E. Orr, J. T. Pennell, C. M. Pierce, M. Scotford, L. R. Severin, E. D. Sylla, M. A. Witt, M. A. Zahn; ***Associate Professors:*** M. A. Atkinson, L. E. Baker-Ward, B. Bennett, H. G. Braunbeck, M. T. Correa, M. K. Cunningham, V. J. Gallagher, S. Greene, T. N. Greenstein, A. F. Khater, M. G. Kim, D. Laryea, R. Leonard, M. M. Magill, L. S. May, L. A. Mykyta, E. O'Sullivan, M. T. Pramaggiore, M. L. Schwalbe, S. M. Setzer, S. L. Spencer, S. R. Stein, M. S. Thompson, P. Tyler, C. A. Warren, S. T. Warren; ***Assistant Professors:*** K. Albada, A. Bolonyai, R. S. Ellovich, K. A. Harwood, D. A. Hooker, B. Kelley, J. L. Lubischer, M. G. Orgeron, M. Wyer

The minor provides graduate students in the humanities, social sciences and sciences with the theories and the methodologies to study women and gender relations. The minor is intended to support and further students' research in their own field. Nine hours of graduate credit are required. No more than three hours of course work may overlap between the major department coursework requirement and the WGS minor. Students may choose from the courses listed below and/or a list of approved special topics courses.

GRADUATE COURSES

ANT 544 Cross-cultural Perspectives on Women
VPH 555 Public Health, Sustainable Development and Gender in Global Context
WGS(PSY) 506 Psychology of Gender
WGS(ECD) 540 Gender Issues in Counseling
WGS(HI) 547 American Women to 1900
WGS(HI) 548 American Women in the 20th Century
WGS 593 Special Topics
WGS(SOC) 704 Feminist Thought in the Social Sciences
WGS(SOC) 737 Sociology of Gender
WGS(SOC) 739 Social Psychology of Inequality
ZO 508 Brain, Sex, and Gender

Biological Sciences

There is no separate graduate major in the biological sciences, but both M.S. and Ph.D. degrees are offered in several life science departments and programs of the College of Agriculture and Life Sciences. Interdisciplinary courses applicable to several graduate programs are offered by the Biological Sciences Interdepartmental Program.

GRADUATE COURSE

BIO 510 Advanced Biology for Secondary Teachers

Education [General Courses]

GRADUATE COURSES

ED(AEE) 501 Foundations of Agricultural and Extension Education
ED(AEE) 530 Priority Management in Agricultural and Extension Education
ED(AEE) 641 Practicum in Agricultural and Extension Education
ED(AEE) 735 Effective Teaching in Agriculture and Life Sciences
ED(AEE) 841 Practicum in Agricultural and Extension Education

Foreign Languages and Literatures

Dr. Ruth Gross, Department Head
NCSU Box 8106
919. 515.2475 (phone)
919. 515.6981 (fax)

Professors: T. Feeny, R. V. Gross, Y. Rollins, M. L. Sosower, M. A. F. Witt; ***Associate Professors:*** V. Bilenkin, H. G. Braunbeck, G. A. Dawes, J. S. Despain, M. D. Garval, H. Jaimes, M. M. Magill, D. M. Marchi, J. Mari, J. P. Mertz, L. Mykyta, M. L. Salstad, E. Tai, A. Taj; ***Assistant Professors:*** M. A. Darhower, S. Garrigan, E. Vilches

The Department of Foreign Languages and Literatures offers courses to assist graduate students in preparing to use modern foreign languages in research and advanced study. These courses are not open to undergraduates. With special permission of the Graduate School, certification may be obtained in languages not normally taught by the department.

The following courses are designed to be audited, and credits do not apply toward advanced degrees.

FLF 401 French for Graduate Students
FLG 401 German for Graduate Students
FLS 401 Spanish for Graduate Students

Multidisciplinary Studies

GRADUATE COURSES

MDS 515 Peruvian Amazon Ecology and Ethnology
MDS 595 Special Topics in Multidisciplinary Studies
MDS 610 Special Topics
MDS 685 Master's Supervised Teaching

Philosophy

GRADUATE COURSES

LOG 535 Advanced Logic and Metamathematics
PHI 515 Life Science Ethics
PHI 520 Global Justice
PHI 522 Philosophical Issues in Environmental Ethics
PHI(PSY) 525 Introduction to Cognitive Science
PHI 540 The Scientific Method
PHI 545 Philosophy of Biology
PHI 550 Software and the Ethics of Ownership
PHI 573 Religion, Gender, and Reproductive Technologies
PHI 575 Ethical Theory
PHI 635 Advanced Independent Study in Philosophy
PHI 798 Advanced Topics in Philosophy
PHI 816 Introduction to Research Ethics

Graduate Faculty

A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z

- Abbate, Angelo Rudy, M.L.A., Professor Emeriti, Landscape Architecture
- Abdel-Khalik, Hany S., PhD, Visiting Assistant Professor, Nuclear Engineering
- Abney, Mark R., PhD, Assistant Professor, Entomology
- Aboelfotoh, Mohamed O., Ph.D., Research Professor, Materials Science and Engineering
- Abrams, Charlie Frank Jr., Ph.D., Professor Emeriti of Biological and Agricultural Engineering, Biological and Agricultural Engineering
- Abt, Karen Lee, PhD, Adjunct Assistant Professor, Forestry
- Abt, Robert C., Ph.D., Professor, Forestry
- Adams, Dewey Allen, Ed.D., Professor Emeritus, Mathematics, Science, & Technology Education
- Aday, David Derek, PhD, Assistant Professor, Zoology
- Ade, Harald, Ph.D., Professor, Physics
- Adler, Kenneth B., Ph.D., Professor, Molecular Biomedical Sciences
- Adler, William, PhD, Professor, Philosophy and Religion
- Afify, Elsayed M., PhD, Professor Emeriti, Mechanical and Aerospace Engineering
- Agris, Paul F., Ph.D., Professor, Biochemistry
- Aiman-Smith, Lynda, Ph.D., Associate Professor, Business Management
- Aiyyer, Anantha, PhD, Assistant Professor, Marine, Earth, and Atmospheric Sciences
- Akroyd, D., Ph.D., Professor, Adult and Higher Education
- Albada-Jelgersma, Kelly, PhD, Associate Professor, Communication
- Alder, Ruth M. Ayend, Ph.D., Associate Professor Emeritus of Foreign Languages and Literatures, Foreign Languages and Literatures
- Aldige, Virginia, Ph.D., Distinguished Professor of Sociology and Anthropology, Sociology and Anthropology
- Alexander, Samuel Thomas, Ph.D., Associate Professor, Electrical and Computer Engineering
- Alexander, Winser E., Ph.D., Professor, Electrical and Computer Engineering
- Allaire, Jason C., PhD, Assistant Professor, Psychology
- Allen, George C. II, PhD, Research Assistant Professor, Horticultural Science
- Allen, Howard Lee, Ph.D., Carl Alwin Schenck Professor, Forestry
- Allen, Jonathan C., Ph.D., Professor, Food Science
- Allen, Michael, PhD, Assistant Professor, History
- Allen, Nina Stromgren, Ph.D., Professor, Plant Biology
- Allen, Steven G., Ph.D., Professor, Business Management
- Alley, Mark, DVM, Assistant Professor, Population Health & Pathobiology
- Almond, Glen W., Ph.D., Professor, Population Health & Pathobiology
- Alonso, Jose M, PhD, Assistant Professor, Genetics
- Alonso, Silvia Gonzalez-Quevedo, Ph.D., Associate Professor Emeritus of Foreign Languages and Literatures, Foreign Languages and Literatures
- Alsbury, Thomas, EdD, Assistant Professor, Educational Leadership and Policy Studies
- Alston-Mills, Brenda P., Ph.D., Professor, Animal Science
- Amatya, Devendra M., Ph.D., Adjunct Assistant Professor, Biological and Agricultural Engineering
- Ambaras, David, Ph.D., Associate Professor, History
- Ambrose, John Thomas, Ph.D., Professor, Entomology
- Amein, Michael, PhD, Professor Emeritus of Civil Engineering, Civil Engineering
- Amerson, Henry Van, Ph.D., Associate Professor, Forestry
- Ames, Natalie, EDD, Assistant Professor, Social Work
- Amezquita, Alejandro, PhD, Adjunct Assistant Professor, Food Science
- Amoozegar, Aziz, Ph.D., Professor, Soil Science
- Anderson, Kenneth E., Ph.D., Professor, Poultry Science
- Anderson, Kevin Lindsay, Ph.D., Professor, Population Health & Pathobiology
- Anderson, Norman Dean, Ph.D., Professor Emeritus of Mathematics and Science Education, Mathematics, Science, & Technology Education

- Andrady, Anthony L., PhD, Adjunct Professor, Chemical Engineering
- Andrews, Janice M., D.V.M., Research Assistant Professor, Population Health & Pathobiology
- Aneja, Viney P., Ph.D., Professor, Marine, Earth, and Atmospheric Sciences
- Anholt, Robert Rene Henri, Ph.D., Professor, Zoology
- Anistratov, Dmitriy Y., Ph.D., Assistant Professor, Nuclear Engineering
- Annetta, Len, PhD, Assistant Professor, Mathematics, Science, & Technology Education
- Anson, Christopher Martin, Ph.D., Professor, English
- Anton, Ana I., Ph.D., Associate Professor, Computer Science
- Apperson, Charles Smith, Ph.D., William Neal Reynolds Professor, Entomology
- Apple, Jay Lawrence, Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Arasu, Prema, Ph.D., Associate Professor, Molecular Biomedical Sciences
- Archie, Joseph Patrick, Jr., Ph.D., Adjunct Professor, Mechanical and Aerospace Engineering
- Arellano, Consuelo, PhD, Research Professor, Statistics
- Arends, James J., PhD, Adjunct Professor, Entomology
- Argyropoulos, Dimitris, PhD, Professor, Wood and Paper Science
- Armstrong, Frank Bradley, Ph.D., Professor Emeritus, Biochemistry
- Arnold, John F., Ph.D., Associate Professor Emeritus of Curriculum and Instruction, Curriculum and Instruction
- Arritt, Fletcher M. III, PhD, Assistant Professor, Food Science
- Arroway, Pamela J., PhD, Assistant Professor, Statistics
- Arumugam, Sankar, PhD, Assistant Professor, Civil Engineering
- Arya, Satya Pal Singh, Ph.D., Professor, Marine, Earth, and Atmospheric Sciences
- Ash, Sarah Liberman, Ph.D., Associate Professor, Food Science
- Ashwell, Christopher Morgan, PhD, Assistant Professor, Poultry Science
- Ashwell, Melissa S., PhD, Assistant Professor, Animal Science
- Aspnes, David E., Ph.D., Distinguished University Professor of Physics, Physics
- Atchley, William R., Ph.D., William Neal Reynolds Distinguished Professor, Genetics
- Atkins, Clarke E., D.V.M., Professor, Department of Clinical Sciences
- Atkinson, Maxine P., Ph.D., Professor, Sociology and Anthropology
- Attarian, Aram, Ph.D., Associate Professor, Parks, Recreation and Tourism Management
- Auerbach, David D., Ph.D., Assistant Professor, Philosophy and Religion
- Aurand, Leonard William, Ph.D., Professor Emeritus of Food Science, Food Science
- Austin, David F., Ph.D., Associate Professor, Philosophy and Religion
- Averre, Charles Wilson III, Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Axtell, Richard Charles, Ph.D., Professor Emeritus of Entomology, Entomology
- Aycock, Robert, Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Ayoub, Mahmoud Amin, Ph.D., Professor, Industrial Engineering
- Azmy, Yousry R., Ph.D., Adjunct Associate Professor, Nuclear Engineering

- Bacheler, Jack S., Ph.D., Professor, Entomology
- Bachmann, Klaus Jurgen, Ph.D., Professor Emeritus of Materials Science and Engineering, Materials Science and Engineering
- Bahler, Dennis R., Ph.D., Associate Professor, Computer Science
- Bailey, Donna W., PhD, Adjunct Assistant Professor, Adult and Higher Education
- Bailey, John Albert, Ph.D., Professor Emeritus of Mechanical and Aerospace Engineering, Mechanical and Aerospace Engineering
- Bailey, Kermit Lavon, M.P.D., Associate Professor, Graphic Design
- Baines, Barbara Joan, Ph.D., Professor Emeriti, English
- Bakalov, Bojko, PhD, Assistant Professor, Mathematics
- Baker, Anne, PhD, Assistant Professor, English
- Baker, Edward A., PhD, Assistant Professor, Business Management
- Baker, George A. III, Ed.D., Professor Emeritus, Adult and Higher Education
- Baker, James Robert, Ph.D., Professor Emeritus of Entomology, Entomology
- Baker, MeeCee, PhD, Adjunct Professor, Agricultural and Extension Education
- Baker, Rodney, DVM, Associate Professor, Population Health & Pathobiology

- Baker, Stanley B., Ph.D., Professor, Curriculum and Instruction
- Baker-Ward, Lynne Elizabeth, Ph.D., Professor, Psychology
- Balaban, John, A.M., Professor, English
- Baliga, B. Jayant, Ph.D., Distinguished University Professor, Electrical and Computer Engineering
- Balik, Charles Maurice, Ph.D., Professor, Materials Science and Engineering
- Balint-Kurti, Peter J., PhD, Assistant Professor (USDA), Plant Pathology
- Ball, David Stafford, Ph.D., Associate Professor, Economics
- Ball, Hershell Ray Jr., Ph.D., Professor Emeritus of Food Science, Food Science
- Ballinger, Walter Elmer, Ph.D., Professor Emeritus of Horticultural Science, Horticultural Science
- Ballington, James Ralph Jr., Ph.D., Professor, Horticultural Science
- Banes, Albert J., PhD, Adjunct Professor, Biomedical Engineering
- Banker, James Roderick, Ph.D., Professor, History
- Banks, Alton J., Ph.D., Professor, Chemistry
- Banks, Harvey Thomas, Ph.D., University Professor and Drexel Professor, Mathematics
- Banks-Lee, Pamela, Ph.D., Associate Professor, Textile and Apparel Management
- Baran, Mesut Ethem, Ph.D., Associate Professor, Electrical and Computer Engineering
- Baran, Perver Korca, Ph.D., Research Associate Professor, Parks, Recreation and Tourism Management
- Bardon, Robert E., Ph.D., Associate Professor, Forestry
- Barker, James Cathey, Ph.D., Professor Emeritus of Biological and Agricultural Engineering, Biological and Agricultural Engineering
- Barker, Roger Lee, Ph.D., Burlington Industries Professor of Textile Technology, Textile Engineering, Chemistry, and Science
- Barlage, Doug, PhD, Assistant Professor, Electrical and Computer Engineering
- Barlaz, Morton A., Ph.D., Professor, Civil Engineering
- Barletta, Kristin Thoney, Ph.D., Associate Professor, Textile and Apparel Management
- Barnes, Harold John, Ph.D., Professor, Population Health & Pathobiology
- Barnes, Jill, PhD, Assistant Professor, Molecular Biomedical Sciences
- Barnes, Jodi, PhD, Assistant Professor, Business Management
- Barnett, Ortus Webb Jr., Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Barnhardt, Robert Alexander, Ed.D., Professor Emeritus, Textile and Apparel Management
- Barnhardt, William Wilton, MS, Associate Professor, English
- Barnhart, Huiman X, PhD, Adjunct Associate Professor, Statistics
- Barr, Steve H., Ph.D., Professor, Business Management
- Barrax, Gerald W., M.A., Professor Emeritus of English, English
- Barrick, Reese E., Ph.D., Adjunct Assistant Professor, Marine, Earth, and Atmospheric Sciences
- Barrie, Thomas M., MPH, Professor, Architecture
- Barthalmus, George Timothy, Ph.D., Professor Emeritus of Zoology and Interim Head of the Department, Zoology
- Bartlett, James, PhD, Associate Professor, Adult and Higher Education
- Bartley, Jon W., Ph.D., Professor, Accounting
- Bassett, Ross K., Ph.D., Associate Professor, History
- Batchelor, Peter, M.C.P., Professor Emeriti of Architecture, Architecture
- Bateman, Durward F., Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Batra, Subhash K., Ph.D., Charles A. Cannon Professor of Textiles, Textile and Apparel Management
- Battaglia, Paul, MA, Assistant Professor, Architecture
- Baugh, John Wesley Jr., Ph.D., Professor, Civil Engineering
- Baughman, Gerald Robert, Ph.D., Associate Professor, Biological and Agricultural Engineering
- Baumer, David L., Ph.D., Associate Professor, Business Management
- Baynes, Ronald E., Ph.D., Associate Professor, Population Health & Pathobiology
- Beal, Candy M., Ed.D., Associate Professor, Curriculum and Instruction
- Bearon, Lucille B, PhD, Associate Professor, Human Development & Family Studies
- Beasley, David Beach, Ph.D., Professor, Biological and Agricultural Engineering
- Beasley, Mark S., Ph.D., Professor, Accounting
- Beck, Keith R., Ph.D., Professor, Textile Engineering, Chemistry, and Science
- Beckmann, Robert L., Ph.D., Associate Professor, Plant Biology

- Bedair, Salah Mohamed, Ph.D., Professor, Electrical and Computer Engineering
- Beers, Burton Floyd, Ph.D., Professor Emeritus of History, History
- Begeny, John C., PhD, Assistant Professor, Psychology
- Behnke, Andrew, Ph.D, Assistant Professor, Human Development & Family Studies
- Beichner, Robert J., Ph.D., Professor, Physics
- Beith, Barry H., Ph.D., Adjunct Associate Professor, Psychology
- Bennett, Barbara, PhD, Assistant Professor, English
- Bennett, Elizabeth M., D.Ed., Adjunct Assistant Professor, Zoology
- Benson, David Michael, Ph.D., Professor, Plant Pathology
- Benson, Geoffrey Alan, Ph.D., Associate Professor, Economics
- Benson, Ray Braman Jr., Ph.D., Research Professor, Materials Science and Engineering
- Beratan, Kathi, PhD, Research Assistant Professor, Forestry
- Bereman, Robert Deane, Ph.D., Professor Emeritus of Chemistry and Associate Dean for Academic Affairs, Chemistry
- Berenson, Sarah Burke, Ph.D., Professor, Mathematics, Science, & Technology Education
- Bergey, Paul K, PhD, Assistant Professor, Business Management
- Bergmann, Ben A., Ph.D., Adjunct Associate Professor, Forestry
- Bernhard, Richard Harold, Ph.D., Professor, Industrial Engineering
- Bernholc, Jerzy, Ph.D., Professor, Physics
- Beute, Marvin Kenneth, Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Bhattacharya, Subhashish, PhD, Assistant Professor, Electrical and Computer Engineering
- Bhattacharyya, Bibhuti Bhushan, Ph.D., Professor, Statistics
- Bigelow, Anna B, PhD, Assistant Professor, Philosophy and Religion
- Bilbro, Griff Luhrs, Ph.D., Professor, Electrical and Computer Engineering
- Bilderback, Theodore Eugene, Ph.D., Professor, Horticultural Science
- Bilenkin, Vladimir, Ph.D., Associate Professor, Foreign Languages and Literatures
- Bingham, Charles S., EdD, Adjunct Assistant Professor, Educational Leadership and Policy Studies
- Bingham, William Louis, Ph.D., Associate Professor Emeritus of Civil Engineering, Civil Engineering
- Bird, Carolyn, PhD, Assistant Professor, 4H Youth Development
- Bird, David M., Ph.D., Professor, Plant Pathology
- Birkenheuer, Adam, PhD, Assistant Professor, Department of Clinical Sciences
- Birkland, Thomas A., PhD, William Kretzer Professor of Public Affairs & Public Policy, School of Public & Intl Affairs, Political Science and Public Administration
- Bishir, John William, Ph.D., Professor Emeritus of Mathematics, Mathematics
- Bishop, Paul Edward, Ph.D., Professor (USDA), Microbiology
- Bissett, Sally, MVS, Assistant Professor, Department of Clinical Sciences
- Bitting, Paul F., Ph.D., Associate Professor, Educational Leadership and Policy Studies
- Bitzer, Donald Lester, Ph.D., Distinguished University Research Professor, Computer Science
- Bivins, Jason C., PhD, Assistant Professor, Philosophy and Religion
- Bizios, Georgia, M.Arch., Professor, Architecture
- Black, Betty Lynne, Ph.D., Professor, Zoology
- Blackley, Brian Mark, PhD, Assistant Professor, English
- Blackwell, Bernie Francis, PhD, Adjunct Professor, Mechanical and Aerospace Engineering
- Blair, Neal Edward, Ph.D., Adjunct Professor, Marine, Earth, and Atmospheric Sciences
- Blanchard, Margaret, PhD, Assistant Professor, Mathematics, Science, & Technology Education
- Bland, George F., M.S., Associate Professor Emeritus of Electrical and Computer Engineering, Electrical and Computer Engineering
- Blank, Gary B., Ph.D., Associate Professor, Forestry
- Blank, Philip Everett Jr., Ph.D., Professor Emeritus of English, English
- Blankenship, Sylvia M., Ph.D., Professor, Horticultural Science
- Blanton, Richard Lawrence, PhD, Professor, Plant Biology
- Blazich, Frank Arthur, Ph.D., Professor, Horticultural Science
- Blikslager, Anthony T., Ph.D., Associate Professor, Department of Clinical Sciences
- Block, William Joseph, Ph.D., Professor Emeritus of Political Science and Public Administration, Political Science and Public Administration

- Bloem, Stephanie, PhD, Adjunct Associate Professor, Entomology
- Blondin, John M., Ph.D., Professor, Physics
- Bloomfield, Peter, Ph.D., Professor, Statistics
- Blum, Udo, Ph.D., Professor Emeritus of Botany, Plant Biology
- Bobashev, Georgiy, PhD, Adjunct Assistant Professor, Statistics
- Bocarro, Jason, PhD, Assistant Professor, Parks, Recreation and Tourism Management
- Bochinski, Jason, PhD, Research Assistant Professor, Physics
- Boettcher, William Alfred III, Ph.D., Associate Professor, Political Science and Public Administration
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- Bogdanovich, Alexander, PhD, Adjunct Professor, Textile Engineering, Chemistry, and Science
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University Copyright Procedures

Equal Opportunity and Non-Discrimination

It is the policy of the State of North Carolina to provide equality of opportunity in education and employment for all students and employees. Accordingly, the university does not practice or condone unlawful discrimination in any form against students, employees or applicants on the basis of race, color, religion, creed, sex, national origin, age, disability or veteran status. Nor does the university allow discrimination on the basis of sexual orientation with respect to internal university matters that do not contravene federal or state law and that do not interfere with the University's relationships with outside organizations, including the federal government, the military, ROTC, and private employers. [NOTE: The NC State University equal opportunity and nondiscrimination policy includes transsexual individuals within the policy's prohibitions against discrimination on the basis of sex. This includes actual or perceived gender identity and gender expression. See Price Waterhouse v. Hopkins, 490 U.S. 228 (1989); Smith v. City of Salem, 378 F.3d 566 (6th Circ. 2004).] Retaliation against any person complaining of discrimination is in violation of federal and state law and North Carolina State University policy, and will not be tolerated.

Unlawful Harassment

Harassment based upon race, color, religion, creed, sex, national origin, veteran status, age, or disability is a form of discrimination in violation of federal and state law and North Carolina State University policy and will not be tolerated. It is the internal policy of North Carolina State University to prohibit harassment on the basis of sexual orientation. Retaliation against any person complaining of harassment is in violation of federal and state law and North Carolina State University policy, and will not be tolerated. North Carolina State University will respond promptly to all complaints of harassment and retaliation. Violation of this policy can result in serious disciplinary action up to and including expulsion for students or discharge for employees.

Every individual is encouraged, and should feel free, to seek assistance, information and guidance from his/her supervisor, the Office for Equal Opportunity, the Office of Student Conduct or the Employees Relations section of Human Resources. For additional information, contact: Office for Equal Opportunity, 1 Holladay Hall, Box 7530, North Carolina State University, Raleigh, NC 27695-7530, Phone: (919) 513-1234 or 515-3148.

Disability Services Office

Individuals desiring reasonable accommodations for their documented disabilities should contact

the Disability Services Office (DSO), Suite 1900, Student Health Center, 2815 Cates Avenue, (919) 515-7653 (Voice), (919) 515-8830 (TTY). Services and accommodations are provided based on an individual's documented needs and are determined in consultation with the individual and a DSO representative. For students, such requests should be made far in advance of registration deadlines to ensure timely services and accommodations. DSO will maintain appropriate confidentiality of records and communication regarding disability.

North Carolina State University

Graduate Catalog

Other Resources

The following resources are not only essential components of graduate education at NC State, but can also enhance the graduate experience. Each college has a wealth of material about their specific facilities. Additional information is also available in the New Student Survival Guide.

Graduate Calendar
Graduate Student Association
Health Services
Housing
Information Technology Division
NCSU Libraries
Map of the Campus
Research Centers
Schedule of Required Documents

NORTH CAROLINA STATE UNIVERSITY
ACADEMIC CALENDAR FOR GRADUATE STUDENTS
Summer 2007 - Spring 2008

This calendar is subject to periodic review and revision.
Please check with the University Registrar and/or the Graduate School to determine if changes have been made.

FIRST SUMMER SESSION, 2007

May 18	Fri	*Early Thesis Deadline for submission of theses or dissertations to the Graduate School, in final form as approved by advisory committees, by candidates for master's and doctoral degrees in August 2007,* ***in order to avoid registering for summer sessions or paying tuition for summer. All theses and dissertations will be submitted online as ETD's.***
May 21	Mon	First day of classes
May 22	Tues	Last day to add a course without permission of instructor
May 23	Wed	●**Census Day:** *The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m. on this day.* ●Last day to register (includes payment of tuition and fees) or to add a course. ●Last day to drop a course with a tuition adjustment.
May 28	Mon	Memorial Day Holiday (University Closed)
June 1	Fri	●Departmental recommendations for US citizen applicants for Second Summer Session 2007 due in Graduate Admissions Office. ●First day to submit a North Carolina Residency Application to the Graduate School for Fall, 2007
June 5	Tues	●Last day to withdraw or drop a course without a grade at the 400-level or below. ●Last day to change from credit to audit at the 400-level or below. ●Last day to change to credit only.
June 6	Wed	●Last day to withdraw or drop a course without a grade at the 500-900 level. ●Last day to change from credit to audit at the 500-900 level.
June 12	Tues	Electronic Thesis and Dissertation Workshop ITTC Labs, D. H. Hill Library, 1:30 to 3:30 p.m.)
June 22	Fri	Last day of classes
June 25	Mon	Graduate application deadline for U.S. Citizens applying for Fall 2007 admission, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm
June 25-26	Mon-Tues	Final Exams

SECOND SUMMER SESSION, 2007

July 2	Mon	●Diploma Request Cards (DOR) and Option B forms due to Graduate School for Summer 2007 Graduation. ●First day of classes
July 3	Tues	Last day to add a course without permission of instructor
July 4	Wed	Independence Day (University closed.)
July 5	Thurs	●**Census Day:** *The tuition and fees charge is based on the official number of hours and courses carried at 5:00 p.m. on this day.* ●Last day to register (includes payment of tuition and fees) or to add a course. ●Last day to drop a course with a tuition adjustment.
July 6	Fri	*Thesis Deadline - for initial submission of theses or dissertations to the Graduate School, in final form as approved by advisory committees, by candidates for master's and doctoral degrees in August, 2007. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.*
July 15	Sun	●Graduate application deadline for international applicants for Spring 2008 admission, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm ●Deadline for departmental recommendations for U.S. citizen applicants for Fall 2007 due in Graduate Admissions Office.
July 17	Tues	●Last day to withdraw or drop a course without a grade at the 400-level or below. ●Last day to change from credit to audit at the 400-level or below. ●Last day to change to credit only.
July 18	Wed	●Last day to withdraw or drop a course without a grade at the 500-900 level. ●Last day to change from credit to audit at the 500-900 level.
July 19	Thurs	Electronic Thesis and Dissertation Workshop ITTC Labs, D. H. Hill Library, 1:30 to 3:30pm)
Aug 3	Fri	●Last day of classes. ●*Final Electronic Thesis/Dissertation (ETD) Due: Last day by which a graduate student must complete ALL final revisions to ETD and receive approval by the Graduate School in order to graduate in August, 2007.*
Aug 5	Sun	●Deadline for departmental recommendations for international students for Spring, 2008 due in Graduate Admissions Office.
Aug 6-7	Mon-Tues	Final Exams
Aug 7	Tues	Last day to submit a North Carolina Residency Application to the Graduate School for Summer, 2007
Aug 8	Wed	Summer graduation date but no commencement program is held. Summer graduates may participate in following Fall Commencement.

FALL SEMESTER, 2007

Aug 16, 20 & 22	Thurs, Mon & Wed	ITA English Proficiency Screening - SPEAK Test. 9:00 a.m. to 12:00 noon, Foreign Languages and Technology Center. Contact Dr. Melissa Bostrom at 515-2293 or melissa_bostrom@ncsu.edu for information.
Aug 21	Tues	●**New Graduate Student Orientation**, 9:00 a.m. to 5:00 p.m., McKimmon Center. For more information, contact Ms. Aixa Morales-Diaz in the Graduate School at 515-4391 or aixa_morales-diaz@ncsu.edu. ●**NC State University Teaching Orientation**, 1:00 to 5:00 p.m., McKimmon Center. For more information, contact Dr. Barbi Honeycutt at the Faculty Center for Teaching and Learning at 513-4322 or barbi_honeycutt@ncsu.edu. ●**NC State University Research Orientation**, 1:00 to 5:00 p.m., McKimmon Center. For more information, contact Ms. Aixa Morales-Diaz in the Graduate School at 515-4391 or aixa_morales-diaz@ncsu.edu. ●**NO REGISTRATION REQUIRED THESIS REVIEW DEADLINE** - 5:00 p.m. today - date by which a graduate student must (1) successfully pass the final oral exam and (2) complete a thesis review with the Thesis Editor in order to graduate at the end of the current semester, *without the necessity of registering for classes in the current semester*.
Aug 22	Wed	First day of classes
Aug 28	Tues	Last day to add a course without permission of instructor
Aug 30	Thurs	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Sept. 3	Mon	Holiday (Labor Day) University Closed
Sept. 4	Tues	Classes resume at 8:05 a.m.
Sept 5	Wed	●**Census Day:** *The tuition and fees charge is based on the official number of hours and courses carried at 11:59 p.m. on this day.* ●Last day to register or to add a course. ●Last day to drop a course or change from credit to audit with a tuition adjustment.
Sept. 19	Wed	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 1:00 to 3:00)
Sept 25	Tues	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 1:30 to 3:30)
Oct 1	Mon	First date to submit a Residency Application to the Graduate School for Spring 2008.
Oct 3	Wed	●**OPTION B DEADLINE - Non-Thesis Students** - 5:00 p.m. today - Date by which Option B forms *accompanied by* Diploma Order Request Cards are due to the Graduate School in order to graduate in the current semester.
Oct 4	Thurs	●Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Oct 10	Wed	Fall Break begins at 10:15 p.m.
Oct 11-12	Thurs-Fri	Fall Break - No classes

Oct 15	Mon	●Classes resume at 8:05 a.m. ●Registration advising for 2008 Spring Semester begins
Oct 16	Tues	Registration for 2008 Spring Semester begins
Oct 17	Wed	●Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 1:30 to 3:30) ●Last day to withdraw or drop a course without a grade at the 400 level or below. ●Last day to change from credit to audit at the 400 level or below or to change to credit only. ●Last day to request course repeat without penalty.
Oct 26	Fri	●Last day to withdraw or drop a course without a grade at the 500-900 level. ●Last day to change from credit to audit at the 500-900 level.
Nov 9	Fri	**REGISTRATION REQUIRED THESIS REVIEW DEADLINE** - 5:00 p.m. today - Date by which a graduate student must (1) successfully pass the final oral exam and (2) complete a thesis review with the Thesis Editor in order to graduate at the end of the current semester.
Nov 14	Wed	Deadline for receipt of exception requests in the Graduate School for the Graduate Student Support Plan (GSSP) for Fall 2007 Semester.
Nov 20	Tues	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon)
Late November		ITA English Proficiency Screening - SPEAK Test - (dates, times, location TBA). Contact Dr. Melissa Bostrom at 515-2293 or melissa_bostrom@ncsu.edu for information.
Nov 21-23	Wed-Fri	Thanksgiving Holiday for students (University closed November 22-23)
Nov 25	Sun	Graduate application deadline for U.S. citizens applying for Spring 2008 admission, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm
Nov 26	Mon	Classes resume at 8:05 a.m.
Nov 28	Wed	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 9:30 to 11:30 am)
Dec 7	Fri	●Last day of classes ●**REGISTRATION REQUIRED FINAL ETD DEADLINE** - 5:00 p.m. today - Date by which a graduate student who is expecting to graduate at the end of the current semester, must submit the final, error free PDF file of his/her Electronic Thesis/Dissertation (ETD) in order to graduate at the end of the current semester.
Dec 10-18	Mon-Tues	Final examinations
Dec 15	Sat	●Graduate application priority deadline for international applicants applying for First or Second Summer Session 2008 admission, *however*, departmental priority deadlines may be earlier. Check by visiting:

		http://www2.acs.ncsu.edu/grad/prospect.htm. ●Departmental recommendations for US citizen applicants for Spring Semester 2008 due in Graduate Admissions Office.
Dec 18	Tues	Last date to submit a North Carolina Residency Application to the Graduate School for Fall 2007.
Dec 19	Wed	**GRADUATION DATE** - The date degrees are conferred for the current semester. For Fall Graduation, this is also the date of the Graduation Exercises.
Dec. 24-31	Mon-Mon	Winter Holiday, University closed

SPRING SEMESTER, 2008

Early January		●ITA English Proficiency Screening - SPEAK Test - (dates, times, location TBA) Contact Dr. Melissa Bostrom at 515-2293 or melissa_bostrom@ncsu.edu for information. ●UNC Campus Scholarship and Diversity Graduate Assistant Grant (*Applications are available from the Graduate School Diversity Programs Office, 1575 Varsity Drive, Flex Lab, Module 6*). ●Graduate programs should identify all master 's students planning May 2008 graduation and begin requests for permit to schedule the final oral examination.
Jan 8	Tues	**NO REGISTRATION REQUIRED THESIS REVIEW DEADLINE** - 5:00 p.m. today - date by which a graduate student must (1) successfully pass the final oral exam and (2) complete a thesis review with the Thesis Editor in order to graduate at the end of the current semester, *without the necessity of registering for classes in the current semester*.
Jan 9	Wed	First day of classes
Jan 15	Tues	●Last day to add a course without permission of instructor. Pack TRACS closes for adds at 11:59 p.m. (After today, adds are processed in Room 1000, Harris Hall.) ●Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.) ●Preferred Spring 2008 GSSP Exception Deadline: Preferred deadline for receipt of exception requests in the Graduate School for the Graduate Student Support Plan (GSSP) for Spring 2008 semester in order to advise students in a more timely manner regarding registration prior to census.
Jan 21	Mon	Holiday (Martin Luther King Jr. Day); University closed.
Jan 23	Wed	●**Census Day:** *The tuition and fees charge is based on the official number of hours and courses carried at 11:59 p.m. on this day.* ●Last day to register or to add a course. ●Last day to drop a course or change from credit to audit with a tuition adjustment.
Jan 24	Thurs	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 1:30 to 3:30 p.m.)

Feb 8	Fri	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Feb 12	Tues	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Feb 20	Wed	●**OPTION B DEADLINE - Non-Thesis Students** - 5:00 p.m. today - Date by which Option B forms *accompanied by* Diploma Order Request Cards are due to the Graduate School in order to graduate in the current semester. ●Last day to withdraw or drop a course without a grade at the 400 level or below. ●Last day to change from credit to audit at the 400 level or below. ●Last day to change to credit only.
Mar 1	Sat	●Graduate application priority deadline for international applicants applying for Fall 2008, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm. ●First day to submit a North Carolina Residency Application to the Graduate School for First Summer Session 2008.
Mar 3-7	Mon-Fri	Spring Break - no classes
Mar 4	Tues	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Mar 10	Mon	●Classes resume at 8:05 a.m. ●Advising begins for registration for 2008 Summer Sessions and 2008 Fall Semester
Mar 11	Tues	Registration begins for the 2008 Summer Sessions and 2008 Fall Semester.
Mar 12	Wed	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Mar 19	Wed	●Last day to withdraw or drop a course without a grade at the 500-900 level. ●Last day to change from credit to audit at the 500-900 level. ●Pack TRACS closes for graduate drops at 11:59 p.m.
Mar 21	Fri	Spring Holiday - no classes
Mar 24	Mon	Classes resume at 8:05 a.m.
Mar 25	Tues	Graduate application priority deadline for U.S. citizen applicants for First Summer Session 2008 admission, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm
Mar 28	Fri	**REGISTRATION REQUIRED THESIS REVIEW DEADLINE** - 5:00 p.m. today - Date by which a graduate student must (1) successfully pass the final oral exam and (2) complete a thesis review with the Thesis Editor in order to graduate at the end of the current semester.
Early April		ITA English Proficiency Screening - SPEAK Test - (dates, times, location TBA). Contact Dr. Melissa Bostrom at 515-2293 or melissa_bostrom@ncsu.edu for information.

Apr 2	Wed	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 1:30 to 3:30 p.m.)
Apr 3	Thurs	ACAAGS Banquet (Association for the Concerns of African-American Graduate Students) - 5:30 p.m., McKimmon Center. For additional information, contact the Graduate School at 513-8096.
Apr 17	Thurs	Electronic Thesis and Dissertation Workshop (ITTC Lab, D. H. Hill Library, 10:00 to 12:00 noon.)
Apr 18	Fri	Deadline for receipt of exception requests in the Graduate School for the Graduate Student Support Plan (GSSP) for Spring 2008 Semester (Approval of exceptions subject to budget availability).
Apr 25	Fri	●Last day of classes. ●**REGISTRATION REQUIRED FINAL ETD DEADLINE** - 5:00 p.m. today - Date by which a graduate student who is expecting to graduate at the end of the current semester, must submit the final, error free PDF file of his/her Electronic Thesis/Dissertation (ETD) in order to graduate at the end of the current semester.
Apr 28 - May 6	Mon-Tues	Final examinations
May 1	Thurs	First day to submit a North Carolina Residency Application to the Graduate School for Second Summer Session 2008.
May 6	Tues	Last Date to submit a North Carolina residency application to the Graduate School for Spring 2008.
May 10	Sat	●Graduate application priority deadline for U.S. citizens applying for Second Summer Session 2008, *however*, departmental deadlines may be earlier. Check by visiting: http://www2.acs.ncsu.edu/grad/degree.htm. ●**GRADUATION DATE** - The date degrees are conferred for the current semester. For Spring Graduation, this is also the date of the Graduation Exercises.

Note: Dates are subject to change. Revised: November 2007

Schedule of Required Documents

Required Forms/Actions*	***When Required***	***Who Initiates***
Complete, official transcripts from universities and colleges attended, including degrees and dates awarded	Before the beginning of the first semester of enrollment	Student is responsible for providing official transcripts to the Graduate School.
Signature of *Patent Agreement*	Before the end of the first semester of enrollment	Initiated by student and submitted to the Graduate School by the graduate program.
Request for appointment of advisory committee (doctoral students only)	Before completion of one semester of course work or earlier	Student meets with DGP and request is submitted to the Graduate School by the graduate program.
Proposed *Plan of Graduate Work* (doctoral students only)	After completion of 12 hours of required course work or earlier	Initiated by student with Advisor and approved by DGP; submitted to the Graduate School by the graduate program. Graduate School responds with approval or declination within 10 working days of receipt.
Assignment of Graduate School Representative (doctoral students only)	After *Plan of Graduate Work* has been approved by Graduate School	Appointed by the Graduate School.
Request to Schedule the Preliminary Oral Examination (doctoral students only)	After written preliminary exams have been completed but no later than one semester prior to final oral exam. Request must be received in Graduate School at least 5-10 working days prior to proposed exam date (see right).	Initiated by student and submitted to the Graduate School by the graduate program. The Graduate School responds in 5 working days if a Graduate School Representative (GSR) has already been assigned. If not, the Graduate School may take up to 10 working days to respond.
Report on Preliminary Oral Examination (doctoral students only)	Immediately after oral examination is completed	Submitted to the Graduate School by the graduate program within 5 working days of exam.
Diploma Order Request Card (DOR)	***Thesis Students*** – due with Final Oral Exam Report ***Non-Thesis Students*** – due with Option B Form.	Initiated by student (cards available in departments). DOR returned to the department after completed.
Request to Schedule the Final Oral Examination (doctoral students only)	Must be received in Graduate School at least 5-10 working days prior to proposed exam date (see right), and no earlier than 4 calendar months after successful completion of preliminary exam	Initiated by student and submitted to the Graduate School by the graduate program. The Graduate School responds in 5 working days if a GSR has already been assigned. If not, the Graduate School may take up to 10

		working days to respond.
Request for a Permit to Schedule the Master's Oral Examination (Master's students only)	Must be received in the Graduate School at least 10 working days before the examination is scheduled	Initiated by student and submitted to the Graduate School by the graduate program. The Graduate School may take up to 10 working days to respond to the request.
Report on Final Oral Examination (Master's or doctoral) ***accompanied by*** Diploma Order Request Card	Immediately after final oral exam	Both forms submitted to the Graduate School by the DGP within 5 working days of exam.
Request for Option B Graduation Checkout (Master's students in Option B program only) ***accompanied by*** Diploma Order Request Card	No later than the sixth week after the first day of the semester in which the student plans to graduate (7 working days after the first day of SS I for summer graduates)	Initiated by the student and both forms submitted to the Graduate School by the DGP.
Draft submission of thesis or dissertation to Graduate School for thesis review	Immediately after final examination is successfully completed ***and*** all required signatures on title page (*within 24 hours of completing both acts*). Both acts must be completed by the graduation deadline for the semester as noted in the Graduate School Calendar.	Student must electronically submit both the draft PDF file ***and*** signed title page to the Thesis Editor via the ETD submission system for the thesis review. Student incorporates edits recommended by advisory committee and Thesis Editor.
Final submission of thesis or dissertation to Graduate School for Graduate School acceptance.	Final error free file must be submitted before the graduation deadline for the semester as noted in the Graduate School Calendar.	Student must electronically submit the final error free file to the Thesis Editor via the ETD submission system for acceptance by the Graduate School. Student will be electronically notified when the final error free file is accepted.

North Carolina State University

Graduate Catalog

Catalog Archives

Incoming students are governed by the rules and regulations in force the semester they are accepted into a program. Previous Graduate Catalogs can be downloaded in PDF format here.

Graduate Catalog (Spring 2007)
Graduate Catalog (Fall 2006)
Graduate Catalog (Spring 2006)
Graduate Catalog (Fall 2005)
Graduate Catalog (Spring 2005)
Graduate Catalog (Fall 2004)
Graduate Catalog (Spring 2004)
Graduate Catalog (Fall 2003)