

# NC State 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.

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

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## 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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## 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.

## 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.

### Application

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:

1. 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	18 points
Reading	18 points
Writing	18 points
Speaking	18 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

2. The maximum total score for the iBT is 120 with each section worth 30 points.
3. Provide [International English Language Testing System](#) (IELTS) scores with an overall band score of **at least 6.5**. Minimum test scores for each section are listed below:

Listening	6.5
Reading	6.5
Writing	6.5
Speaking	6.5 for admission to the Graduate School
	7.0 for TA appointment

4. be a citizen of a [country where English is an official language](#) and the language of instruction in higher education; or
5. have successfully completed at least one year of full-time study in a degree program at a four-year US College or university.
6. TOEFL or IELTS test date must be **no older** than two years (24 months) prior to the beginning of the requested entry term.

**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. Computer-based TOEFL scores must be 213 or higher (with at least 17 on three sections and no section score below 13). The paper-based test requires a score of 550 or higher (with scores of 50 on at least two of the three sections and no section score below 45).

## **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.

## **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.

## **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.

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.

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.

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

## 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.

## 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.

### 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 <sup>1</sup> 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 semester, or one (1) hour of XXX 688 (Non-Thesis Master's Continuous Registration-Half Time Registration) for students who have completed <sup>3</sup> 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) 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 <sup>2</sup> 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.	Registration for 3-8 credit hours per Fall or Spring semester, or one (1) hour of XXX 699 (Master's Thesis Preparation) for students who have completed <sup>4</sup> 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 <sup>5</sup> 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 <sup>6</sup> 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.

<sup>1</sup>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.

<sup>2</sup>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.

<sup>3</sup>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.

<sup>4</sup>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.

<sup>5</sup>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.

<sup>6</sup>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 Bachelors/Masters 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 within 12 months of completing the Bachelor's degree or obtain a thesis based Master's degree within 24 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 *MyPack* alone, or during the second week, via *MyPack* and with permission of the instructor. In a summer session, courses may be added during the first two days via *MyPack* alone, and/or during the third and fourth days via *MyPack* 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 *MyPack* 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 or 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 18 or fewer hours at the 400 level or above and have less than a 3.00 GPA. Graduate students are placed on academic probation if they have accumulated more than 18 hours at the 400 level or above and have a GPA in the range of 2.67 to 2.99 and will be ineligible for financial aid or appointment or reappointment to an assistantship or fellowship. A student's graduate study is terminated if they have accumulated more than 18 hours at the 400 level or above and have a GPA below 2.67 or if they have accumulated 30 or

more hours and have less than a 3.0 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 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.

## **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](#)

## **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](#)

### **Admission to Degree Programs**

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.

## 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 \(GRE, TOEFL for internationals\)](#)

[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 \(GRE\)](#)

[Teaching - MA \(GRE\)](#)  
[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.

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## **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](#)

[E-Learning](#)

[Geographic Information Systems](#)

[Horticultural Science](#)

[Medical Devices](#)

[Molecular Biotechnology](#)

[Nonprofit Management](#)

[Nonwovens Science and Technology](#)

[Program Development in Family Life Education](#)

[Public Policy](#)

[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
<a href="#">Accounting</a>					Y		

## GRADUATE FACULTY

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

### *Director of Graduate Programs:*

K. A. Krawczyk, Box 8113, 515.4439, [katherine\\_krawczyk@ncsu.edu](mailto: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, 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 three criteria:

- undergraduate academic record and grade point average;
- GMAT score\*;
- "Leadership" -- such as 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 (IT) or Enterprise Risk Management (ERM).

**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 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

## Adult and Higher Education

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Adult and Community College Education</u></a>		Y	Y			Y	
<a href="#"><u>Higher Education Administration</u></a>		Y	Y			Y	
<a href="#"><u>Human Resource Development</u></a>			Y				
<a href="#"><u>Training and Development</u></a>						Y	

### GRADUATE FACULTY

C. E. Kasworm, *Department Head*

#### *Director of Graduate Programs:*

D. Akroyd, Box 7801, 515.1745, [duane\\_akroyd@ncsu.edu](mailto:duane_akroyd@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:* 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, P. Umbach; *Adjunct Associate Professors:* B. I. Mallette; *Assistant Professors:* T. A. Bowles, S. Bracken, A. N. Bryant, D. D. Chapman, A. J. Jaeger, P. Lari, J. Storberg-Walker, C. A. Wiessner; *Adjunct Assistant Professors:* D. W. Bailey, B. Brown, P. H. Clayton, 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](http://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](http://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](http://www7.acs.ncsu.edu/financial_aid).

## GRADUATE COURSES

EAC 517 Current Issues in Higher Education  
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 Higher 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 544 History of the College Student Experience in the United States  
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 560 Assessment and Evaluation in Adult and Higher Education  
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 Programs  
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 Higher Education  
EAC 624 Topical Problems in Adult and Higher Education  
EAC 630 Independent Study in Adult and Higher Education  
EAC 641 Practicum in Health Occupations  
EAC 651 Internship in Adult and Higher 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 Higher 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 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 Higher 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 Seminar in Adult and Higher Education  
 EAC 803 Research Seminar in Adult and Higher Education  
 EAC 824 Topical Problems in Adult and Higher Education  
 EAC 830 Independent Study in Adult and Higher Education  
 EAC 841 Practicum In Health Occupations  
 EAC 851 Internship in Adult and Higher 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

## Agricultural and Extension Education

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Agricultural and Extension Education</u></a>		Y					
<a href="#"><u>Agricultural Education</u></a>			Y		Y		
<a href="#"><u>Extension Education</u></a>			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](mailto: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 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 the GRE, 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 [Registration and Records Course Inventory](#) 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

## **Analytics**

### **Degrees Offered:**

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Analytics</a>			Y				

## GRADUATE FACULTY

### *Director of Graduate Programs:*

M. A. Rappa, Box 7268, 424.4550, [mrappa@ncsu.edu](mailto: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 degree with a strong practical orientation designed to give students a thorough understanding of the tools, methods, and applications of advanced analytics. The curriculum is designed entirely for MSA students and classes are taught as a cohort. Students work frequently in teams and receive hands-on training with industry-standard software tools. Its educational objectives include but are not limited to topics, such as data quality and integration, data and text mining, time series forecasting, optimization, survival analysis, and other areas of statistics; data security and privacy; project management and communication skills. 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, but not limited to: financial analytics, fraud detection, and risk management; marketing optimization, customer analytics and web analytics; clinical and biological data analysis; and data mining for 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 seats 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 education in the software 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 February 15 (January 15 for international applicants).

## GRADUATE COURSES

AA 591A Statistical Foundations for Analytics  
AA 591B Analytics Methods and Applications I  
AA 591C Analytics Practicum I  
AA 591D Analytics Seminar  
AA 591E Analytics Methods and Applications II  
AA 591F Analytics Practicum II  
AA 691 Analytics Software Tools

## Animal Science

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Animal Science</a>			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](mailto:char_farin@ncsu.edu), Animal Science

*William Neal Reynolds Professor:* J. Odle

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

**Professors:** L. S. Bull, J. H. Eisemann, K. L. Esbenshade, C. E. Farin, W. L. Flowers, B. A. Hopkins, J. Luginbuhl, 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:** B. P. Alston-Mills, K. R. Butcher, E. V. Caruolo, J. C. Cornwell, 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:** J. P. Cassady, V. Fellner, G. B. Huntington, S. W. Kim, 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, M. E. Hockett, H. Liu, C. Maltecca, S. E. Pratt, J. E. Turner; **Research Assistant Professors:** L. Xi; **Adjunct Assistant Professors:** D. S. Casey, J. V. Felts, A. Gernat, C. L. Heggen-Peay, R. O. Maguire, T. F. Middleton

### 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(NTR) 516 Animal Nutrition Research Methods  
ANS 520 International Livestock Production  
ANS 530 Advanced Applied Animal Reproduction  
ANS 540 Selection of Domestic Animals  
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 575 Current Topics in Genomics and Proteomics in Animal Science  
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(NTR) 701 Protein and Amino Acid Metabolism  
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
<a href="#">Animal Science &amp; Poultry Science</a>	Y						

### GRADUATE FACULTY

#### *Directors of Graduate Programs:*

C. E. Farin, Box 7621, 515.4022, [char\\_farin@ncsu.edu](mailto:char_farin@ncsu.edu), Animal Science

J. T. Brake, Box 7608, 515.5060, [jbrake@ncsu.edu](mailto: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:* K. E. Anderson, L. S. Bull, 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., B. A. Hopkins, J. Luginbuhl, R. L. McCraw, W. E. M. Morrow, J. F. Ort, S. L. Pardue, C. R. Parkhurst, J. N. Petite, R. M. Petters, M. H. Poore, O. W. Robison, M. T. See, 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:* B. P. Alston-Mills, K. R. Butcher, T. A. Carter, E. V. Caruolo, V. L. Christensen, J. C. Cornwell, R. G. Crickenberger, W. E. Donaldson, J. D. Garlich, E. W. Glazener, P. B. Hamilton, J. R. Harris, R. W. Harvey, G. B. Havenstein, C. H. Hill, W. L. Johnson, J. R. Jones, C. A. Lassiter, J. G. Lecce, R. D. Mochrie, R. M. Myers, F. D. Sargent, B. W. Sheldon, J. C. Wilk, G. H. Wise; *Associate Professors:* D. K. Carver, J. P. Cassady, V. Fellner, G. B. Huntington, S. W. Kim, J. A. Moore, P. E. Mozdziak, C. H. Stahl, 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, 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(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 540 Selection of Domestic Animals  
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 575 Current Topics in Genomics and Proteomics in Animal Science  
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(NTR) 701 Protein and Amino Acid Metabolism  
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 Current Concepts in 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

## Anthropology

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Anthropology</a>				Y			

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

A. L. Schiller, Box 8107, 515.9015, [anne\\_schiller@ncsu.edu](mailto:anne_schiller@ncsu.edu), Anthropology

*Associate Professors:* N. Haenn, A. H. Ross, J. M. Wallace III, W. Wormsley; *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 bioarchaeology. 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

## Architecture

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Architecture</a>					Y		

### GRADUATE FACULTY

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

#### *Director of Graduate Programs:*

D. B. Hill, Box 7701, 515.8357, [david\\_hill@ncsu.edu](mailto:david_hill@ncsu.edu), Architecture

*Alumni Distinguished Professor of Architecture:* J. W. Place

*Alumni Distinguished Professor of Architecture and Director of Graduate Program:* J. P. Rand

*Graduate Alumni Distinguished Professor of Architecture:* R. H. Clark

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

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 534 Design of Architectural Details  
 ARC 543 Analysis of Precedent  
 ARC 544 Architectural Conservation  
 ARC 546 Theory of Building Types  
 ARC 548 Vernacular Architecture  
 ARC 561 The Practice of Architecture  
 ARC 562 Legal Issues in Architecture  
 ARC 570 Anatomy of the City  
 ARC 571 The Urban House  
 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

## Art and Design

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Art and Design</a>					Y		

## GRADUATE FACULTY

C. D. Cox, *Department Chair*

### *Director of Graduate Programs:*

S. D. Brandeis, Box 7701, 515.3876, [susan\\_brandeis@ncsu.edu](mailto: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; **Assistant Professors:** M. Freeman II, J. Wan

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.

**Masters Degree Requirements:** The program of study requires a minimum of 48 credit hours of graduate work depending on background preparation of the applicant. A separate track of 60 credit hours accommodates 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

## Biochemistry

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Biochemistry</a>	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](mailto:stu_maxwell@ncsu.edu), Biochemistry

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

***Professors:*** P. F. Agris, D. T. Brown, 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, R. B. Rose; ***Adjunct Associate Professors:*** R. E. Cannon; ***Assistant Professors:*** M. B. Goshe, F. Meilleur

## 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

## Biological and Agricultural Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Biological and Agricultural Engineering</u></a>	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](mailto: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, P. L. Mente, G. T. Roberson; *Assistant Professors:* F. Birgand, M. Burchell III, M. S. Chin, G. L. Grabow, W. F. Hunt III, P. Kolar, S. Shah, R. Sharma, M. W. Veal, L. Wang, M. Youssef; *Research Assistant Professors:* G. M. Chescheir, O. D. Simmons III; *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

## Biomathematics

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Biomathematics</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

A. L. Lloyd, Box 8203, 515.1910, [alun\\_lloyd@ncsu.edu](mailto:alun_lloyd@ncsu.edu), Biomathematics

*Burroughs Wellcome Distinguished Professor:* J. E. Riviere

*Camille Dreyfus Distinguished University Professor:* C. K. Hall

*Distinguished 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, S. R. Lubkin, 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. V. Muse, M. Olufsen, C. E. Smith; *Assistant Professors:* K. Gross

### 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. Additional information on requirements, courses, faculty and current research can be found at the website [www.ncsu.edu/biomath](http://www.ncsu.edu/biomath).

**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, letters of recommendation, and the personal statement. 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 591 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 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

## Biomedical Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Biomedical Engineering</a>	Y		Y				

## GRADUATE FACULTY

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

### Director of Graduate Programs:

S. B. Knisley, Box 8301, 966.6653, [sknisley@email.unc.edu](mailto: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, D. S. Lalush, M. G. McCord, P. L. Mente, 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:** E. G. Loba, G. S. McCarty, 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, J. Cavanagh, A. E. Tonelli, M. Chow, R. P. Gardner, R. M. Grossfeld, S. A. Hale, C. Kleinstreuer, H. Krim, A. V. Kuznetsov, S. R. Lubkin, N. A. Monteiro-Riviere, S. A. Rajala, W. E. Snyder, L. F. Stikeleather, M. K. Stoskopf, D. E. Thrall, M. A. V. Vouk; **Research Professors:** W. C. Holton; **Associate Professors:** J. J. Brickley, G. D. Buckner, D. R. Cormier, M. A. Haider, O. Harrysson, G. Lazzi, J. F. Muth, M. Olufsen, A. Rabiei, M. K. Ramasubramanian, S. C. Roe, S. Seelecke, C. E. Smith, A. M. Stomp; **Assistant Professors:** R. E. Gorga; **Adjunct Assistant Professors:** M. Ghovanloo

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. 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<sup>th</sup> 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 Ph.D. 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 543 Cardiovascular Biomechanics  
 BME 550 Medical Imaging: Ultrasonic, Optical, and Magnetic Resonance  
 BME 551 Medical Device Design I  
 BME 552 Medical Device Design II  
 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>

## Business Management

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Business Administration</a>					Y		

## GRADUATE FACULTY

S. H. Barr, *Department Head*

### Director of Graduate Programs:

S. G. Allen, Box 7229, 515.5584, [steve\\_allen@ncsu.edu](mailto: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, D. L. Baumer, Y. A. Chen, R. L. Clark, C. P. Jones, R. Kouri, S. E. Margolis, M. Montoya-Weiss, A. Padilla, D. P. Pagach, I. R. Weiss; *Professors Emeriti:* J. R. Canada, G. W. Dickson, D. M. Holthausen Jr.; *Associate Professors:* L. Aiman-Smith, E. A. Baker, P. K. Bergey, J. Bohlman, C. C. Bozarth, M. Bradford,

S. N. Chapman, B. Danielsen, K. S. Davis, J. C. Dutton Jr., J. B. Earp, D. H. Henard, S. K. Markham, J. K. McCreery, K. Mitchell, P. W. Mulvey, C. M. Newmark, F. C. Payton, J. C. Poindexter Jr., B. B. Tyler, M. D. Walker, R. S. Warr, G. S. Young, G. J. Zuckerman; *Associate Professors Emeriti*: C. W. Harrell Jr., E. A. McDermed; *Assistant Professors*: J. Barnes, T. Caner, T. Hollmann, W. Kang, S. Moon, C. Rossetti, S. Schanz, D. Sirdeshmukh, M. A. Stanko, D. M. Townsend, D. Warsing, J. Zhao

## ASSOCIATE MEMBERS OF THE PROGRAM

**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, 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](http://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.

MBA 500 Managerial and Career Effectiveness  
MBA 503 Survey of Accounting  
MBA 504 Data Analysis and Forecasting Methods for Management  
MBA 505 Global Economics for Managers  
MBA 520 Managerial Finance  
MBA 530 Managing the Global High-Tech Workforce  
MBA 540 Operations and Supply Chain Management  
MBA 550 Management of Technology and Innovation  
MBA 560 Marketing Management and Strategy  
MBA 580 Global Strategy

**Technical Concentration:** Minimum of 12 hours of courses in one of the following areas: Biotech/Pharmaceuticals Management, Financial Management, Marketing Management, Product Innovation Management, Services Management, Supply Chain Management, and Technology Entrepreneurship

**Electives:** Minimum of 15 hours for full-time students; minimum of nine (9) hours for part-time students.

**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

MBA 500 Managerial and Career Effectiveness  
MBA 501 Legal and Regulatory Environment in Management  
MBA 503 Survey of Accounting  
MBA 504 Data Analysis and Forecasting Methods for Management  
MBA 505 Global Economics for Managers  
MBA 508 Global Management Simulation  
MBA 510 Information Technology Management



MBA 511 Networking Infrastructure for E-commerce  
 MBA 513 Database Management  
 MBA 514 Technology, Law and the Internet  
 MBA 515 Enterprise Systems  
 MBA(CSC) 516 E-Commerce Practicum  
 MBA 520 Managerial Finance  
 MBA 521 Advanced Corporate Finance  
 MBA 522 Security Analysis and Portfolio Management  
 MBA 523 Investment Theory and Practice  
 MBA 524 Financial Markets and Institutions  
 MBA 526 International Finance  
 MBA 527 Corporate Risk Management with Derivatives  
 MBA 528 Short-term Capital Management  
 MBA 529 New Firm Financing  
 MBA 530 Managing the Global High-Tech Workforce  
 MBA 532 Strategic Human Resource Management  
 MBA 533 Leadership in Management  
 MBA 540 Operations and Supply Chain Management  
 MBA 541 Supply Management  
 MBA 542 Supply Chain Logistics  
 MBA 543 Planning and Control Systems  
 MBA 545 Management Support Systems  
 MBA 546 Analysis and Design of Management Support Systems  
 MBA 547 Management Support Systems Project  
 MBA 549 Managerial Issues in Information Systems  
 MBA 550 Management of Technology and Innovation  
 MBA 553 Business Process Design and Analysis  
 MBA 554 Project Management  
 MBA 555 Product Design and Development  
 MBA 560 Marketing Management and Strategy  
 MBA 562 Research Methods in Marketing  
 MBA 563 Product and Brand Management  
 MBA 573 Supply Chain Management  
 MBA(MSE) 576 Technology Evaluation and Commercialization Concepts  
 MBA(MSE) 577 High Technology Entrepreneurship  
 MBA(MSE) 578 Implementing Technology Commercialization Strategies  
 MBA 579 Entrepreneurship  
 MBA 580 Global Strategy  
 MBA(TTM) 585 Market Research in Textiles  
 MBA 590 Special Topics in Business Management  
 MBA 610 Special Topics in Business Administration  
 MBA 630 Independent Study  
 MBA 688 Non-Thesis Master's Continuous Registration - Half-Time Registration  
 MBA 689 Non-Thesis Master's Continuous Registration - Full-Time Registration

## Chemical Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Chemical Engineering</a>	Y		Y		Y		

### GRADUATE FACULTY

P. S. Fedkiw, *Department Head*



**Director of Graduate Programs:**

S. A. Khan, Box 7905, 515.4519, [khan@eos.ncsu.edu](mailto:khan@eos.ncsu.edu), Chemical Engineering

**Hoechst Celanese Professor Emeritus:** R. M. Felder

**Alcoa Professor of Chemical Engineering:** R. M. Kelly

**Camille Dreyfus Distinguished University Professor:** C. K. Hall

**Camille Dreyfus Professor:** H. B. Hopfenberg

**Distinguished University Professor:** D. F. Ollis

**Frank Hawkins Kenan Distinguished Professor of Chemical Engineering:** R. G. Carbonell

**William R. Kenan Jr. Distinguished Professor and Mary Ann Smith Professor:** J. M. DeSimone

**Worley H. Clark Jr. Distinguished Professor:** K. E. Gubbins

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

## **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
<a href="#">Chemistry</a>	Y		Y		Y		

### GRADUATE FACULTY

M. G. Khaledi, *Department Chair*

#### *Director of Graduate Programs:*

C. B. Gorman, Box 8204, 515.4252, [chris\\_gorman@ncsu.edu](mailto:chris_gorman@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, 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; **Adjunct Professors:** T. Gunnoe; **Professors Emeriti:** R. D. Bereman, C. L. Bumgardner, 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:** M. T. Oliver-Hoyo, A. I. Smirnov, W. L. Switzer, J. L. White; **Associate Professors Emeriti:** C. B. Boss, T. C. Caves, D. W. Wertz; **Assistant Professors:** A. Deiters, R. A. Ghiladi, L. He, E. A. Ison, P. Maggard, C. C. Melander, A. A. Nevzorov, T. I. Smirnova, L. A. Sombers

## 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. 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 711 Advanced Analytical Chemistry I  
 CH 713 Advanced Analytical Chemistry II  
 CH 714 Electronics and Instrumentation 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 736 Chemical Spectroscopy  
 CH 737 Quantum Chemistry  
 CH 743 Electrochemistry  
 CH 745 Chemical Separation  
 CH 755 Organic Reaction Mechanisms  
 CH 759 Natural Products  
 CH 765 Chemistry of Materials  
 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

## Civil Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Civil Engineering</a>	Y		Y		Y		

### GRADUATE FACULTY

G. F. List, *Department Head*

#### *Director of Graduate Programs:*

V. C. Matzen, Box 7908, 515.7736, [matzen@ncsu.edu](mailto:matzen@ncsu.edu), Civil Engineering

*Distinguished Professor:* S. H. Rizkalla

*Distinguished Professors:* D. W. Johnston

*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, N. P. P. Khosla, Y. R. Kim, D. R. Knappe, G. F. List, V. C. Matzen, J. M. Nau, M. F. Overton, M. S. Rahman, S. R. Ranjithan, W. J. Rasdorf, N. M. Roupail, J. R. Stone; *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:* F. L. de los Reyes III, J. J. Ducoste, M. N. Guddati, A. Gupta, T. Hassan, M. J. Kowalsky, M. L. Leming, G. Mahinthakumar, R. Seracino, A. A. Tayebali, B. M. Williams Jr.; *Adjunct Associate Professors:* N. Abdel-Rahman, L. R. Goode, D. R. van der Vaart; *Associate Professors Emeriti:* W. L. Bingham, A. C. Chao, E. D. Gurley, J. C. Smith; *Assistant Professors:* S. Arumugam, C. P. Bobko, J. F. DeCarolus, T. M. Evans, M. Liu, E. A. Sumner III, J. Yu

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 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 Advanced Civil Engineering Seminar  
 CE 802 Advanced Seminar in Civil Engineering Computing  
 CE 803 Advanced Seminar in Construction Engineering  
 CE 804 Advanced Seminar in Geotechnical Engineering  
 CE 805 Advanced Seminar in Structural Mechanics  
 CE 806 Advanced Seminar in Transportation Engineering  
 CE 807 Advanced 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
<a href="#">Communication</a>			Y				

### GRADUATE FACULTY

K. Zagacki, *Interim Department Head*

#### *Director of Graduate Programs:*

M. A. Johnson, Box 8104, 515.9756, [melissa\\_johnson@ncsu.edu](mailto:melissa_johnson@ncsu.edu), Communication

**Professors:** D. Berube, 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, K. Kosenko, 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. The degree prepares students 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 9 hours in communication theory, 6 hours in communication research methods and 12 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 529 Communication Campaigns  
 COM(PA) 539 Fund Development  
 COM 541 Quantitative Research Methods in Applied Communication  
 COM 542 Qualitative Research Methods in Applied Communication  
 COM 546 Nonprofit Marketing and Public Relations  
 COM 556 Seminar in Organizational Communication  
 COM 561 Human Communication Theory  
 COM 562 Communication and Social Change  
 COM 566 Seminar in Crisis Communication  
 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

## Communication, Rhetoric and Digital Media

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Communication Rhetoric and Digital Media</u></a>	Y						

## GRADUATE FACULTY

### *Director of Graduate Programs:*

J. Packer, Box 8101, 515.9744, [jpacker@ncsu.edu](mailto:jpacker@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, D. Berube, 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

## Comparative Biomedical Sciences

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Comparative Biomedical Sciences</a>	Y		Y				

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

S. L. Jones, Box 8401, 513.7722, [sam\\_jones@ncsu.edu](mailto:sam_jones@ncsu.edu), Comparative Biomedical Sciences

*Burroughs Wellcome Distinguished Professor:* J. E. Riviere

*William Neal Reynolds Professor:* R. R. H. Anholt

*Professors:* K. B. Adler, G. W. Almond, K. L. Anderson, P. Arasu, H. J. Barnes, E. B. Breitschwerdt, T. T. Brown Jr., J. M. Cullen, G. A. Dean, D. C. Dorman, L. N. Fleisher, F. J. Fuller, J. E. Gadsby, 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:* R. Baker, R. E. Baynes, A. T. Blikslager, M. Breen, M. T. Correa, P. Cowen, P. W. Farin, 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:* J. A. Dye, W. A. Gebreyes, R. W. Litaker, R. C. Sills; *Assistant Professors:* J. Barnes, A. Birkenheuer, J. L. Davis, S. Y. Gardner, T. Ghashghaei, I. Gimeno, J. Gookin, M. L. Hauck, Y. Kim, K. E. Linder, N. Nascone-Yoder, M. Rodriguez-Puebla, G. Smith, J. Yoder; *Research Assistant Professors:* 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

## Computer Networking

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Computer Networking</a>			Y				

### GRADUATE FACULTY

#### *Directors of Graduate Programs:*

D. J. Thunte, Box 8206, 515.7003, [thunte@csc.ncsu.edu](mailto:thunte@csc.ncsu.edu), Computer Science  
 H. J. Trussell, Box 7911, 515.5091, [hjt@ncsu.edu](mailto:hjt@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:* 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, A. I. Anton, 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, M. E. Baran, G. T. Byrd, A. G. Dean, R. Dutta, G. Lazzi, V. Misra, J. F. Muth, P. Ning, I. Rhee, E. Rotenberg, W. Wang, M. W. White, L. A. Williams; *Assistant Professors:* D. Barlage, H. Dai, W. R. Davis, M. Escuti, D. Y. Eun, K. Gard, X. Liu, S. Sair, M. L. Sichitiu, Y. Solihin, J. M. Tuck III; *Adjunct Assistant Professors:* L. J. Bottomley, M. Ghovanloo, 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

Select one of the following business courses:

MBA 554 Project Management (Summer, Fall, Spring)

MBA 590 Special Topics: Management Foundations (Fall)

MBA 590 Special Topics: Service Management (Spring)

## **TECHNICAL CONCENTRATIONS**

CSC 501 Operating System Principles

CSC/ECE 506 Architecture of Parallel Computers

CSC/ECE 510 Software Engineering

CSC 513 E-Commerce technology

CSC/MBA 516 E-commerce Practicum

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 714 Real-Time Computer Systems

CSC 715 Concurrent Software System

CSC 716 Design of Secure and Reliable Systems

CSC 750 Service-Oriented Computing

CSC/ECE 773 Advanced Topics in Internet Protocols

CSC/ECE 774 Network Security

CSC/ECE 776 Performance Evaluation of Computer Networks

CSC/ECE 775 Advanced Topics in Wireless Networks

CSC/ECE 777 Telecommunications Network Design

CSC/ECE 779 Advanced Computer Performance Modeling

CSC/ECE 778 Optical Networks

ECE 520 Digital ASIC Design

ECE 521 Computer Design and Technology

ECE 523 Photonics and Optical Communications

ECE 546 VLSI System Design

ECE 714 Random Processes

ECE 733 Digital Electronics

ECE 761 Design Automation for VLSI

## **MANAGEMENT CONCENTRATION**

MBA 503 Survey of Accounting

MBA 514 Technology, Competition and the Law

MBA 520 Managerial Finance

MBA 541 Supply Chain Relationships

MBA 542 Supply Chain Logistics

MBA 543 Planning and Control Systems

MBA 554 Project Management

MBA 576 Technology Evaluation and Commercialization Concepts

MBA 577 High Technology Entrepreneurship

MBA 590 Special Topics: Decision Support Systems

MBA 590 Special Topics: Business Process Analysis and Design

MBA 590 Special Topics: Business Relationship Management

MBA 590 Special Topics: Consulting

MBA 590 Special Topics: Service Management

# Computer Science

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Computer Science</a>	Y		Y		Y		

## GRADUATE FACULTY

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

### *Director of Graduate Programs:*

D. J. Thunte, Box 8206, 515.7003, [thunte@csc.ncsu.edu](mailto:thunte@csc.ncsu.edu), Computer Science

*Distinguished University Research Professor:* D. L. Bitzer

*SAS Institute Distinguished Professor:* J. Doyle

**Professors:** A. I. Anton, 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, M. F. M. Stallmann, W. J. Stewart, A. L. Tharp, D. J. Thunte, M. A. V. Vouk; **Adjunct Professors:** D. A. Reed, P. R. Wurman; **Professors Emeriti:** W. Chou, R. E. Funderlic; **Associate Professors:** D. R. Bahler, R. Y. Chirkova, R. Dutta, V. W. Freeh, K. A. Harfoush, C. G. Healey, T. L. Honeycutt, J. C. Lester, F. Mueller, P. Ning, I. Rhee, N. Samatova, R. A. St. Amant, B. A. Watson, L. A. Williams, R. M. Young; **Assistant Professors:** X. Gu, S. Heber, X. Jiang, X. Ma, K. A. Ogan, T. Xie, T. Yu; **Adjunct Assistant Professors:** J. Kang, 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, W. Wang; **Assistant Professors:** M. L. Sichitiu, Y. Solihin

The Department of Computer Science is one of the leading departments in the country and indeed the world. Recent developments include adding over 20 tenure-track faculty, 18 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 **Theory** (Algorithms, Theory of Computation); **Systems** (Computer Architectures and Operating Systems, Embedded and Real-Time Systems, Parallel and Distributed Systems, Scientific and High Performance Computing); **Artificial Intelligence** (Intelligent Agents, Data-Mining, Information and Knowledge Discovery, Engineering and Management; eCommerce Technologies; Information Visualization, Graphics and Human-Computer Interaction); **Networks** (Networking, Performance Evaluation, Sensor Networks, Protocols); **Security** (Software and Network Systems Security, Information Assurance, Privacy); **Software Engineering** (Requirements, Formal Methods, Reliability Engineering, Process and Methods, Programming Languages); and **Computer-Based Education**. 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 2007-2008 academic year, approximately 200 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, and some 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(MBA) 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(ISE) 546 Management Decision and Control Systems  
CSC 548 Parallel Systems  
CSC 554 Human-Computer Interaction  
CSC(ISE) 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(ISE) 756 Advances in Voice Input/output Communications Systems  
 CSC 761 Advanced Topics in Computer Graphics  
 CSC(OR,ISE) 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

## Curriculum and Instruction

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Counselor Education</u></a>	Y		Y			Y	
<a href="#"><u>Counselor Education, Agency Counseling</u></a>			Y			Y	
<a href="#"><u>Counselor Education, Student Personnel in Higher Education</u></a>			Y			Y	
<a href="#"><u>Curriculum and Instruction</u></a>	Y		Y			Y	
<a href="#"><u>Curriculum and Instruction, English Education</u></a>			Y			Y	
<a href="#"><u>Curriculum and Instruction, Reading</u></a>			Y			Y	
<a href="#"><u>Curriculum and Instruction, Social Studies Education</u></a>			Y			Y	
<a href="#"><u>Instructional Technology - Computers</u></a>			Y			Y	

<a href="#"><u>Middle Grades Education</u></a>			Y			Y	
<a href="#"><u>Special Education</u></a>			Y			Y	
<a href="#"><u>Special Education, Behavior Disorders</u></a>			Y			Y	
<a href="#"><u>Special Education, Learning Disabilities</u></a>			Y			Y	
<a href="#"><u>Special Education, Mental Retardation</u></a>			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:*

E. R. Gerler Jr., Box 7801, 515.5975, [edwin\\_gerler@ncsu.edu](mailto:edwin_gerler@ncsu.edu), Counselor Education

R. J. Pritchard, Box 7801, 515.1784, [ruie\\_pritchard@ncsu.edu](mailto:ruie_pritchard@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, R. J. Pritchard, E. J. Sabornie, R. D. Safrin, H. A. Spires, E. S. Vasu; **Professors Emeriti:** L. K. Jones, D. D. Locke, B. R. Poulton, N. A. Sprinthall; **Associate Professors:** C. M. Beal, J. K. Lee, S. Nassar-McMillan, J. Nietfeld, J. Osborne, S. S. Osborne, A. J. Reiman, S. S. Snyder, S. R. Ting; **Visiting Associate Professors:** T. H. Stafford Jr.; **Adjunct Associate Professors:** B. Gorham; **Associate Professors Emeriti:** J. F. Arnold, B. C. Talley, L. Thies-Sprinthall; **Assistant Professors:** D. B. Cherukuri, H. Davis, J. DeCuir-Gunby, H. C. Edwards, M. A. Grimmett, L. B. Holcomb, D. W. Lucas, M. M. Manfra, K. M. Oliver, J. R. Smith, M. Stumpf-Downing, C. A. Young; **Research Assistant Professors:** A. Overbay; **Visiting Assistant Professors:** J. S. Hall, H. Lupton-Smith; **Adjunct Assistant Professors:** R. E. Callanan, L. Grable, R. Honeycutt, L. Huffman, S. T. Johnson, M. Monaco, T. E. Ray, R. C. Sutton, R. E. Tyler

## 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 and 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. Doctoral 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. The NC Department of Public Instruction has conferred accreditation to the graduate programs in Curriculum and Instruction. The College of Education is approved by the National Council for Accreditation of Teacher Education (NCATE).

**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.

**Master's of Arts of Teaching:** Beginning in Spring 2009, this new degree program will offer graduate licensure in the following areas that are part of the Department of Curriculum and Instruction: Social Studies Education, English Education, Middle Grades Education, Special Education. Existing graduate courses are part of this degree as well as new courses. The courses with the ED prefix listed below are core courses that MAT students will take across departments.

**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 have teaching experience. The Graduate School requires a 3.0 in the undergraduate program. 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 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 528 Strategies for Teaching English in Secondary Schools  
ECI 529 Special Problems in English Education  
ECI(ELM) 530 Methods and Materials for Teaching Language Arts in the Middle Grades  
ECI 531 Advanced Writing in Education  
ECI 535 Methods and Materials for Teaching Social Studies in the Middle Grades  
ECI(ELM) 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(ELM) 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 563 Methods and Materials for Teaching Secondary Social Studies  
 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 579 Organization and Behavioral Management of Inclusive Classrooms  
 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 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 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 681 Seminar in Special Education Literacy  
 ECI 683 Seminar in Special Education: Learning Strategies  
 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

## Crop Science

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Crop Science</a>	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](mailto: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 Emeritus:* E. A. Wernsman

*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, J. Luginbuhl, 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, R. C. Long, D. E. Moreland, G. F. Peedin, H. Seltsman, G. A. Sullivan, D. L. Thompson, D. H. Timothy, J. B. Weber, W. W. Weeks, A. D. Worsham; *Associate Professors:* D. C. Bowman, J. D. Burton, A. J. Cardinal, D. A. Danehower, L. R. Fisher; *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:* S. E. Johnson, V. Kurapathy, R. Lewis, C. Reberg-Horton, R. Richardson, M. Schroeder-Moreno; *Research Assistant Professors:* S. Milla-Lewis, S. Tallury

### 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), a comprehensive oral examination 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) 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

## Design

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Design</a>	Y						

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

M. J. Davis, Box 7701, 515.8335, [meredith\\_davis@ncsu.edu](mailto:meredith_davis@ncsu.edu), Graphic Design

*Alumni Distinguished Professor of Architecture:* J. W. Place

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

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  
DDN 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

## Economics

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Agricultural and Resource Economics</a>			Y				
<a href="#">Economics</a>	Y			Y	Y		

## GRADUATE FACULTY

### *Director of Graduate Programs:*

T. C. Morant, Box 8110, 515.9367, [tamah\\_morant@ncsu.edu](mailto:tamah_morant@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, P. L. Fackler, D. J. Flath, T. J. Grennes, A. R. Hall, 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, D. M. Holthausen Jr., T. Johnson, C. L. Moore Sr., R. A. Schrimper; **Associate Professors:** D. S. Ball, G. A. Benson, M. Caner, J. Gervais, 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, R. Hammond, I. T. Kandilov, A. G. Leblebicioglu, T. C. Morant, T. Morrill, D. Pelletier, R. M. Rejesus, M. Roberts, R. H. von Haefen, X. Zheng; **Research Assistant Professors:** M. Morrill; **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 700), macroeconomics (ECG 703), statistics (ST 514) 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 and ECG 580. 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 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

# Educational Leadership and Policy Studies

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Educational Administration and Supervision</a>		Y					
<a href="#">Educational Research and Policy Analysis</a>	Y						
<a href="#">School Administration</a>					Y		

## GRADUATE FACULTY

### *Director of Graduate Programs:*

L. D. Fusarelli, Box 7801, 513.0507, [lance\\_fusarelli@ncsu.edu](mailto:lance_fusarelli@ncsu.edu), Educational Research and Leadership

**Professors:** R. C. Serow; **Professors Emeriti:** T. Johnson; **Associate Professors:** P. F. Bitting, L. D. Fusarelli; **Assistant Professors:** T. Alsbury, K. P. Brady, K. H. Brinson Jr., B. C. Fusarelli, R. L. Haley, P. A. Hessling, M. Militello, L. Schoen, T. V. Young; **Visiting Assistant Professors:** H. Lupton-Smith, N. A. Overstreet; **Adjunct Assistant Professors:** C. S. Bingham, K. A. Branch, E. M. Colbert, W. C. Harrison, L. D. Hunt Jr., A. W. Jackl, D. J. Olsen, R. C. Sutton

**Admissions Requirements:** Application materials will include the following.

- Application for admission
- Nonrefundable application fee
- Residency statement
- One official transcript from each school attended
- Official statement of GRE or MAT scores, taken within the last five (5) years. The MSA and Ed.D. programs accept either the GRE or MAT; the Ph.D. program requires applicants to take the GRE only.
- Three (3) letters of reference
- Letter of Application including statement of purpose and career goals
- Resume
- Autobiographical Statement
- Test of English as a Second Language (if required)

Apply online and check the status of your application at: [www2.acs.ncsu.edu/grad/prospect.htm](http://www2.acs.ncsu.edu/grad/prospect.htm).

**Master's Program Requirements:** A minimum of 42 credit hours is required for the Master's of School Administration. Applicants must have a minimum of three (3) years of successful teaching experience and be currently working in a K-12 environment; meet graduate school and program requirements; rolling admissions for on-campus program.

**Ed.D. Program Requirements:** A minimum of 54 credit hours is required for the Ed.D. in Educational Administration and Supervision. Applicants are required to have a North Carolina's Principal's license or be eligible to receive one and to meet graduate school and program requirements. Admissions deadlines for the Ed.D. program are March 31 (Fall) and October 1 (Spring).

### **Ph.D Program Requirements:**

- Bachelor's degree received from an accredited institution; however, a Master's degree is preferred.
- A 3.0 overall GPA in the most recent degree program completed.
- Graduate Record Examination scores that are no more than five (5) years old.
- Evidence of strong analytical, conceptual, and communication skills as assessed in a prescribed written narrative and test scores.

- Completion of an application for admission to the Graduate School.
- Three (3) letters of reference from persons who can attest to the applicant's scholarly aptitude and motivation.
- Official statement of GRE scores.

Deadlines for the receipt of all Ph.D. application materials are November 1 (for Spring admission) and April 1 (for Fall admission).

## **GRADUATE COURSES**

ELP 514 Formative Ideas in American Education  
 ELP 515 Education and Social Diversity  
 ELP 518 Introduction to School Law  
 ELP 520 School Based Budgeting  
 ELP 532 Introduction to Educational Inquiry  
 ELP 534 Ethics for School Decision Making  
 ELP 550 Principles of Educational Administration  
 ELP 551 Context and Challenges of School Improvement  
 ELP 580 Program Planning, Management and Evaluation  
 ELP 589 Personnel Appraisal in Education  
 ELP 595 Advanced Quantitative Applications in School Leadership and Policy  
 ELP 620 Special Problems in Education  
 ELP 651 Internship in Educational Leadership  
 ELP 720 Cases in Educational Administration  
 ELP 724 Contemporary Educational Thought  
 ELP 728 School Law for the Administrator  
 ELP 729 Educational Finance  
 ELP 735 Policy Research in Education  
 ELP 736 Qualitative Research in Education  
 ELP 737 Advanced Qualitative Applications in School Leadership and Policy  
 ELP 742 Applied Research Methods in Education  
 ELP 750 Curriculum History: Challenging Orthodoxies  
 ELP 751 Politics of the P-12 Education  
 ELP 752 Theories Framing Curriculum Inquiry  
 ELP 754 Qualitative Education Research Data Analysis Using Personal Computers  
 ELP 756 Organizational Leadership and Management for School Leaders  
 ELP 780 Evaluation Theory and Practice in Education  
 ELP 789 School Personnel Recruitment, Selection, and Appraisal  
 ELP 795 Special Topics in Educational Research and Leadership  
 ELP 820 Special Problems in Education  
 ELP 851 Internship in Educational Leadership and Program Evaluation  
 ELP 890 Doctoral Preliminary Examination  
 ELP 891 Problems of Research Design in Education  
 ELP 892 Research Projects in Educational Leadership and Program Evaluation  
 ELP 893 Doctoral Supervised Research  
 ELP 895 Doctoral Dissertation Research  
 ELP 896 Summer Dissertation Research  
 ELP 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
<a href="#">Computer Engineering</a>	Y		Y				
<a href="#">Electrical Engineering</a>	Y		Y				

## GRADUATE FACULTY

### *Director of Graduate Programs:*

H. J. Trussell, Box 7911, 515.5091, [hjt@ncsu.edu](mailto:hjt@ncsu.edu), Electrical & Computer Engineering

*Alcoa Professor of Electrical and Computer Engineering:* A. Huang

*Alton and Mildred Lancaster Distinguished Professor:* 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; *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. F. Schetzina, J. J. Wortman; *Associate Professors:* S. T. Alexander, M. E. Baran, J. J. Brickley, G. T. Byrd, A. G. Dean, W. W. Edmonson, K. A. Harfoush, G. Lazzi, V. Misra, T. L. Mitchell, F. Mueller, J. F. Muth, H. O. Ozturk, E. Rotenberg, W. Wang, 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, X. Liu, S. Lukic, S. Sair, D. Schurig, M. L. Sichitiu, Y. Solihin, J. M. Tuck III, C. M. Williams, D. G. Yu; *Research Assistant Professors:* J. M. Wilson; *Adjunct Assistant Professors:* L. J. Bottomley, R. J. Evans, M. Ghovanloo, Y. L. Jou, R. T. Kuehn, A. Montalvo, A. S. Morris III, A. J. Rindos 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, 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 534 Power Electronics  
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 553 Semiconductor Power Devices  
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 600 ECE Graduate Orientation  
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 Integrated Circuit Design for Wireless Communications  
 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 Power Management Integrated Circuits  
 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

## Elementary Education

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Elementary Education</a>			Y			Y	

### GRADUATE FACULTY

E. McIntyre, *Department Head*

E. McIntyre, Box 7801, 513.2810, [ellen\\_mcintyre@ncsu.edu](mailto:ellen_mcintyre@ncsu.edu), Elementary Education

**Professors:** E. McIntyre, P. Sztajn; **Adjunct Associate Professors:** T. Oppewal; **Assistant Professors:** S. Amendum, S. Carrier, M. Jeffries, J. Minogue, M. Pop, A. Wiseman

The mission of the Department of Elementary Education is to develop teacher leaders who have a deep, general content knowledge with a focus in science and mathematics, expert pedagogy, and a commitment to equity and social justice. The Department offers a Masters in Elementary Education – a program designed to prepare education professionals for the 21st century.

**Admission Requirements:** A 500-800 word statement describing professional goals is required. This program requires that applicants hold a baccalaureate-level teaching license. GRE or MAT scores not more than five years old are required for the Master's program

**Master's Degree Requirements:** The M.S. degree requires a total of 39 credit hours -- minimum of 36 course credit hours plus three practicum hours. The M.S. degree also requires (1) a written examination or culminating project, (2) a final oral examination, and (3) thesis approved by the graduate committee.

**Student Financial Support:** No financial aid is available on a regular basis.

### GRADUATE COURSES

ELM 524 Issues in Elementary School Teaching  
 ELM 530 Social Studies in the Elementary School  
 ELM 532 Early Childhood Education  
 ELM 533 Language Arts in the Elementary School  
 ELM 539 Special Problems in Elementary School  
 ELM 540 Reading in the Elementary School  
 ELM 547 Teaching Children's Literature  
 ELM 644 Practicum in Elementary Education  
 ELM 654 Internship in Elementary Education  
 ELM 685 Master's Supervised Teaching  
 ELM 688 Non-Thesis Master's Continuous Registration - Half-Time Registration

ELM 689 Non-Thesis Master's Continuous Registration - Full-Time Registration  
 ELM 690 Master's Examination  
 ELM 691 Research Applications in Elementary Education  
 ELM 692 Master's Research Projects  
 ELM 693 Master's Supervised Research  
 ELM 695 Master's Thesis Research  
 ELM 696 Summer Thesis Research  
 ELM 699 Master's Thesis Preparation

## Engineering - (Off-campus program only)

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Engineering</a>					Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

L. D. Krute, Box 7901, 515.5440, [linda.krute@ncsu.edu](mailto:linda.krute@ncsu.edu), Engineering

#### *Distinguished Professors:* D. W. Johnston

*James T. Ryan Professor and Distinguished University Professor:* 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, 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

# English

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Creative Writing</a>							Y
<a href="#">English</a>				Y			
<a href="#">Technical Communication</a>			Y				

## GRADUATE FACULTY

A. H. Harrison, *Department Head*

### *Directors of Graduate Programs:*

C. A. Prioli, Box 8105, 515.4107, [prioli@ncsu.edu](mailto:prioli@ncsu.edu), English, Creative Writing

R. S. Dicks, Box 8105, 513.7354, [sdicks@unity.ncsu.edu](mailto:sdicks@unity.ncsu.edu), English, 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, D. L. Laux, 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. Pramaggiore, S. M. Setzer, S. Smith McKoy, J. Swarts, E. R. Thomas, C. A. Warren, D. B. Wyrick; **Associate Professors Emeriti:** E. P. Dandridge Jr., M. F. King, C. E. Moore, H. C. West; **Assistant Professors:** A. Baker, B. Bennett, B. M. Blackley, A. Bolonyai, J. Charles, C. J. Crosbie, R. M. Dodsworth, M. K. Dudley, O. Gelley, D. A. Hooker, M. E. Lamont, J. Miller, D. Orgeron, M. Orgeron, J. L. Reaser, D. J. Reavis, D. M. Rieder, T. L. Stinson, R. A. Walsh, 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.

**Requirements for MA in English:** The program requires 32 credit hours. American/British literature and world literature students 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 and rhetoric/composition students take two literature classes of their choice to fulfill the distribution requirement. Film studies students take four literature courses of their choice. In addition, all students must take an introduction to research and bibliography, pass a foreign language reading requirement, and complete a Master's capstone project.

Beyond these basic requirements, the program comprises five concentrations in British 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 capstone project will be 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 (ENG 624) in their third semester.

### **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 592 Special Topics in Film Styles and Genres  
 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 676 Master's Project in English  
 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
<a href="#">Entomology</a>	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](mailto: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, R. L. Brandenburg, F. L. Gould, G. G. Kennedy

*William Neal Reynolds Professor of Entomology and Toxicology:* R. M. Roe

*Professors:* J. T. Ambrose, J. S. Bacheler, F. P. Hain, J. D. Harper, J. R. Meyer, C. E. Sorenson, 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, J. R. Bradley Jr., 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, 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, S. D. Frank, C. M. Grozinger, D. R. Tarpy, M. G. Waldvogel; **Adjunct Assistant Professors:** C. Devorshak

## ASSOCIATE MEMBERS OF THE PROGRAM

**Associate Professors:** W. G. Buhler, N. M. Haddad, W. O. McMillan, D. J. Robison; **Assistant Professors:** D. Buchwalter, R. R. Dunn

Course offerings or research facilities are available in the following areas: agricultural entomology, apiculture, aquatic entomology, 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 who have had these courses from another institution can be exempted from taking them with the permission of the instructor. The instructor will meet with the student and determine, through oral and/or written questioning, whether they have adequate background. 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 who have had these courses from another institution can be exempted from taking them with the permission of the instructor. The instructor will meet with the student and determine, through oral and/or written questioning, whether they have adequate background. 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(GN) 527 Insect Neurogenomics  
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
<a href="#"><u>Fiber and Polymer Science</u></a>	Y						

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

W. Oxenham, Box 8301, 515.6573, [william\\_oxenham@ncsu.edu](mailto: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. Pourdeyghi

***Professors:*** C. M. Balik, K. R. Beck, N. L. Cassill, T. G. Clapp, 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, C. L. Bumgardner, J. A. Cuculo, R. A. Donaldson, A. H. M. El-Shiekh, P. L. Grady, S. P. Hersh, C. D. Livengood, 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, M. R. Jones, 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, W.

E. Krause, E. G. Loba, M. Pasquini, X. Zhang; *Visiting Assistant Professors*: R. Liu, 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

## **Financial Mathematics**

### **Degrees Offered:**

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Financial Mathematics</a>					Y		

### **GRADUATE FACULTY**

#### ***Director of Graduate Programs:***

J. S. Scroggs, Box 8205, 515.7817, [scroggs@ncsu.edu](mailto:scroggs@ncsu.edu), Financial Mathematics

***Professors:*** R. H. Bernhard, P. Bloomfield, D. A. Dickey, P. L. Fackler, S. K. Ghosh, K. Ito, N. G. Medhin, S. G. Pantula, J. J. Seater, T. Vukina, J. R. Wilson; ***Associate Professors:*** J. S. Scroggs, C. E. Smith; ***Assistant Professors:*** M. Kang, T. Pang, D. Pelletier

The Departments of Agricultural and Resource Economics, Economics, Industrial and Systems Engineering, Mathematics, and Statistics offer a program leading to the degree of Master of Financial Mathematics. After completing the core requirements, students choose electives to suit their individual needs and interests.

**Admissions Requirements:** Applicants for admission should have an undergraduate degree that would preferably include courses in advanced calculus, modern algebra, and linear algebra. It is strongly recommended that applicants take the GRE Advanced Test in Mathematics.

**Master of Financial Mathematics Requirements:** In addition to course requirements (six core courses and four electives), the Master of Financial Mathematics degree requires completion of a three-credit internship or research project.

**Student Financial Support:** No financial aid is available on a regular basis. Some funding is available through a limited number of scholarships. Consideration for the scholarships is automatic.

## REQUIRED CORE COURSES

ECG(MA) 790 Advanced Special Topics  
 ECG 590 Special Economics Topics (Asset Pricing)  
 ISE 711 Capital Investment Economic Analysis  
 MA(ST) 546 Probability and Stochastic Processes I  
 MA 547 Financial Mathematics  
 ST 522 Statistical Theory II

## GRADUATE COURSES

MBA 522 Portfolio and Capital Market Theory  
 MBA 526 International Finance  
 MBA 529 New Firm Financing  
 MBA 590 Special Topics in Business Management (Advanced Corporate Finance)  
 ECG 716 Topics in Environmental and Resource Economics  
 ECG 749 Monetary Aspects Of International Trade  
 ECG(ST) 751 Econometrics  
 ECG(ST) 752 Topics in Econometrics  
 ECG 784 Advanced Macroeconomics  
 ISE 709 Dynamic Programming  
 ISE 712 Bayesian Decision Analysis for Engineers and Managers  
 MA(ST) 747 Probability and Stochastic Processes II  
 MA(ST) 748 Stochastic Differential Equations  
 MA 584 Numerical Solution of Partial Differential Equations-Finite Difference Methods  
 ST 730 Applied Time Series Analysis  
 ST 782 Time Series Analysis: Time Domain  
 ST 783 Time Series Analysis: Frequency Domain  
 ST 810 Advanced Topics in Statistics

## Fisheries and Wildlife Sciences

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Fisheries and Wildlife Sciences</a>	Y		Y		Y		

## GRADUATE FACULTY

### Director of Graduate Programs:

C. E. Moorman, Box 7646, 515.5578, [chris\\_moorman@ncsu.edu](mailto:chris_moorman@ncsu.edu), Fisheries and Wildlife

**Professors:** R. J. Borski, R. D. Brown, H. V. Daniels, D. B. Eggleston, 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, C. E. Sorenson, M. K. Stoskopf, C. V. Sullivan;

**Research Professors:** S. Kennedy-Stoskopf; **Professors (USDI/USFS):** J. A. Collazo, J. E. Hightower, T. R. Simons;



**Professors Emeriti:** G. T. Barthalmus, P. T. Bromley, B. J. Copeland, P. D. Doerr, R. L. Noble; **Associate Professors:** J. A. Buckel, W. G. Cope, L. A. Degernes, J. Godwin, N. M. Haddad, C. A. Harms, G. R. Hess, J. M. Hinshaw, C. E. Moorman, S. A. C. Nelson; **Associate Professors (USDI/USFS):** T. J. Kwak; **Adjunct Associate Professors:** W. G. Dorgeloh; **Assistant Professors:** C. S. DePerno, M. N. Peterson, R. Richardson; **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, and 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 516 Advanced Parasitology  
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(VPH) 720 Epidemiology of Wildlife Diseases

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

ST 506 Sampling Animal Populations  
 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 721 Fishery Science  
 ZO(MEA) 756 Ecology of Fishes  
 ZO 784 Advanced Topics in the Study of Mammals  
 ZO 789 Advanced Limnology

## Food Science

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Food Science</a>	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](mailto: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; **Research Associate Professors:** J. Simunovic; **Assistant Professors:** F. M. Arritt III, L. S. Goodell, D. J. Hanson, G. K. Harris, T. G. Phister; **Assistant Professors (USDA):** F. Breidt, J. P. Davis, L. L. Dean, I. M. Perez-Diaz; **Adjunct Assistant Professors:** A. Amezcuita

## ASSOCIATE MEMBERS OF THE PROGRAM

**Professors:** K. E. Anderson, S. A. Hale, H. M. Hassan, T. J. Hoban, S. A. Khan; **Professors Emeriti:** 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(NTR) 510 Food Lipids: Issues and Controversies  
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(NTR) 706 Vitamin Metabolism  
FS(NTR) 710 Food Lipids

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
<a href="#">French Language and Literature</a>				Y			
<a href="#">Spanish Language and Literature</a>				Y			

### GRADUATE FACULTY

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

### 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 503 Issues in the Acquisition of L1 and L2 French  
 FLF 511 Approaches to French Translation  
 FLF 516 Art and Society in France  
 FLF 521 French Cultures and Contexts  
 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 509 Spanish Phonetics and Phonology  
 FLS 510 Spanish Dialectology  
 FLS 511 Spanish Sociolinguistics  
 FLS 519 Children's Literature of Spain Since 1950  
 FLS 520 Spanish American Women Writers  
 FLS 525 Poetry and Politics in Latin America  
 FLS 530 The Cultural Production of Spanish Democracy  
 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
<a href="#">Forestry</a>	Y		Y		Y		

## GRADUATE FACULTY

B. Goldfarb, *Department Head*

### *Director of Graduate Programs:*

S. T. Warren, Box 8008, 515.7996, [sarah\\_warren@ncsu.edu](mailto:sarah_warren@ncsu.edu), Forestry

*Carl Alwin Schenck Professor:* H. L. Allen

*Edwin F. Conger Professor and Distinguished University Professor:* R. R. Sederoff

*Jordan Family Distinguished Professor for Natural Resources Innovation Professor:* V. L. Chiang

**Professors:** R. C. Abt, R. R. Braham, R. D. Brown, R. I. Bruck, F. W. Cubbage, L. J. Frampton Jr., E. C. Franklin, D. J. Frederick, B. Goldfarb, 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, W. E. Winner; **Research Professors:** W. S. Dvorak, B. Li; **Professors (USDA):** F. E. Bridgwater Jr.; **Adjunct Professors:** R. G. Campbell, B. Dimitriades, P. M. Dougherty, C. Greenberg, J. Laarman, J. P. McTague, M. Olsson, K. H. Riitters, D. N. Wear; **Professors Emeriti:** A. W. Cooper, E. B. Cowling, C. B. Davey, P. D. Doerr, D. L. Holley Jr., R. C. Kellison, B. J. Zobel; **Associate Professors:** R. E. Bardon, G. B. Blank, B. P. Bullock, H. Cheshire, D. Hazel, G. R. Hess, J. S. King, C. E. Moorman, S. A. C. Nelson, D. J. Robison, T. H. Shear, E. O. Sills, J. L. Stape, T. A. Steelman, A. M. Stomp, S. T. Warren, R. W. Whetten; **Research Associate Professors:** G. R. Hodge; **Associate Professors (USDA):** S. G. McNulty; **Adjunct Associate Professors:** B. A. Bergmann, W. G. Dorgeloh, T. R. Fox, J. Iames, D. L. Loftis, G. Sun, R. H. Wynne; **Associate Professors Emeriti:** H. V. Amerson; **Assistant Professors:** C. S. DePerno, A. James, M. A. Megalos, M. N. Peterson; **Research Assistant Professors:** K. Beratan, H. I. Cakir, G. Catts, J. Domec, F. Isik, F. Koch, A. Noormets, K. Potter, Y. T. Yamamoto; **Visiting Assistant Professors:** S. Moore, S. Pattanayak; **Adjunct Assistant Professors:** K. L. Abt, D. M. Amatya, M. C. Conner, J. Coulston, C. B. Davidson, P. J. Donoso, B. Hannrup, T. P. Holmes, J. F. Knight, C. Maier, D. E. Mercer, A. Myburg, J. U. Nilsson, J. Phelan, J. P. Prestemon, R. Rubilar, F. G. Sanchez, J. L. Schuler, L. Van Zyl, B. Washburn

## 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 the following requirements: (1) take a one-credit research methodology course, FOR 603 or 803, early in his/her program; (2) take a seminar course (typically FOR 601/801), for students starting in their program in Fall 2008 or later; and (3) 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 Research Methods in Forestry and Environmental Resources  
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 Research Methods in Forestry and Environmental Resources



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
<a href="#">Genetics</a>	Y		Y		Y		

### GRADUATE FACULTY

S. E. Curtis, *Department Head*  
 S. E. Curtis, Box 7614, 515.2292, [securtis@ncsu.edu](mailto: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:* Z. Zeng

*William Neal Reynolds Professor and Distinguished University Professor:* T. F. Mackay

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

### ASSOCIATE MEMBERS OF THE PROGRAM

*Professors:* R. R. H. Anholt, R. S. Boston, R. A. Dean, M. M. Goodman, F. L. Gould, L. K. Hanley-Bowdoin, T. R. Klaenhammer, S. A. Lommel, R. R. Sederoff, W. F. Thompson, C. H. Opperman, D. Robertson; *Named Professors Emeriti:* E. J. Eisen, E. A. Wernsman; *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 521 Molecular Genetics  
GN(ENT) 527 Insect Neurogenomics  
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 Advanced 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(MB,PBPP) 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

## Genomic Sciences

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Bioinformatics</a>	Y				Y		
<a href="#">Functional Genomics</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Directors of Graduate Programs:*

D. M. Bird, Box 7566, 515.6813, [david\\_bird@ncsu.edu](mailto:david_bird@ncsu.edu), Functional Genomics  
Z. Zeng, Box 7566, 515.1942, [zeng@stat.ncsu.edu](mailto: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 Distinguished University Professor:* R. R. Sederoff

*Jordan Family Distinguished Professor for Natural Resources Innovation Professor:* V. L. Chiang

*William Neal Reynolds Distinguished Professor:* W. R. Atchley, W. F. Boss

*William Neal Reynolds Professor:* R. R. H. Anholt, R. S. Boston, J. Cavanagh, M. Davidian, R. A. Dean, L. K. Hanley-Bowdoin, S. A. Lommel, J. Odle, G. A. Payne, Z. Zeng

*William Neal Reynolds Professor and Distinguished University Professor:* T. F. Mackay

*William Neal Reynolds Professor and Head of Botany Department:* M. E. Daub

*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, P. Arasu, D. M. Bird, R. J. Borski, E. B. Breitschwerdt, D. T. Brown, S. D. Clouse, S. E. Curtis, G. A. Dean, R. E. Dewey, C. E. Farin, L. J. Frampton Jr., F. J. Fuller, J. E. Gadsby, S. K. Ghosh, B. Goldfarb, C. L. Hemenway, J. M. Hughes-Oliver, E. L. Kaltofen, S. Leath, D. H. Ley, J. W. Mahaffey, E. S. Maxwell, S. E. McKeand, E. S. Miller, J. W. Moyer, D. C. Muddiman, C. H. Opperman, P. E. Orndorff, J. N. Petite, 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:* G. C. Gibson, N. L. Kaplan, M. D. Purugganan, R. D. Wolfinger; *Associate Professors:* J. M. Alonso, M. Breen, J. W. Brown, J. P. Cassady, A. C. Clark, J. Godwin, A. M. Grunden, J. M. Haugh, J. M. Horowitz, S. Kathariou, D. S. Lalush, C. Mattos, W. O. McMillan, 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.; *Associate Professors Emeriti:* H. V. Amerson; *Assistant Professors:* C. M. Ashwell, M. S. Ashwell, J. Barnes, I. Carbone, R. G. Franks, M. B. Goshe, C. M. Grozinger, B. J. Grubb, S. Heber, M. Koci, L. Li, H. Liu, J. L. Lubischer, L. D. Mathies, A. A. Motsinger, J. W. Olson, M. Rodriguez-Puebla, H. I. A. Sederoff, M. L. Sikes, E. A. Stone, J. Tzeng, P. Veronese, H. (. Wang, D. Xie, J. Yoder; *Research Assistant Professors:* P. A. Estes, F. Isik, D. M. Nielsen; *Assistant Professors (USDA):* I. M. Perez-Diaz; *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 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, Bioinformatics 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.

## Global Innovation Management

Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Global Innovation Management</a>					Y		

## GRADUATE FACULTY

**Director of Graduate Programs:**

D. H. Henard, Box 7229, 515.8945, [dhhenard@ncsu.edu](mailto:dhhenard@ncsu.edu), Global Innovation Management

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

## 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. GMAT or GRE scores are required of all applicants. International applicants must complete the TOEFL.

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:**

MBA 554 Project Management

MBA 590 Special Topics in Business Management (Business Relationship Management)

MBA 590 Special Topics in Business Management (Technology & Innovation Management)

#### **Elective Courses:**

MBA 504 Technology, Competition, and the Law

MBA 570 Entrepreneurship

MBA 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.

## **Graphic Design**

#### **Degrees Offered:**

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Graphic Design</a>					Y		

#### **GRADUATE FACULTY**

S. Piedrafitra, *Department Head*

#### **Director of Graduate Programs:**

M. J. Davis, Box 7701, 515.8335, [meredith\\_davis@ncsu.edu](mailto: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. Piedrafitra, S. Townsend; **Assistant Professors:** 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 5. 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

# History

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">History</a>				Y			
<a href="#">Public History</a>				Y			

## GRADUATE FACULTY

J. K. Ocko, *Department Head*

### *Director of Graduate Programs:*

K. P. Luria, Box 8108, 513.2224, [luria@social.chass.ncsu.edu](mailto:luria@social.chass.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. 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, B. Sirota; **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 566 Readings in Native American History  
 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
<a href="#">Horticultural Science</a>	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](mailto: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. McCartney, 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, D. R. Panthee, 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 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 seven 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) 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

## Human Development & Family Studies

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Human Development &amp; Family Studies-Family Life &amp; Parent Educ</a>			Y				

### GRADUATE FACULTY

R. M. Stewart, *Department Head*

#### *Director of Graduate Programs:*

K. B. DeBord, Box 7605, 515.9147, [karen\\_debord@ncsu.edu](mailto: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, C. Bird, 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 533 Family Dysfunction and Complex Family Issues  
 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

## Immunology

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Immunology</a>	Y		Y				

## GRADUATE FACULTY

### Director of Graduate Programs:

S. L. Tonkonogy, Box 8401, 513.6252, [sue\\_tonkonogy@ncsu.edu](mailto: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:** L. C. Hudson, S. L. Jones, M. B. McCaw, S. L. Tonkonogy; **Assistant Professors:** A. Birkenheuer, M. Koci, 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 prior experience in a research laboratory setting, 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 (Immunology) 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 Current Concepts in 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

# Industrial Design

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Industrial Design</a>					Y		

## GRADUATE FACULTY

B. W. Laffitte, *Department Head*

### *Director of Graduate Programs:*

P. R. Hooper, Box 7701, 515.8324, [percy\\_hooper@ncsu.edu](mailto:percy_hooper@ncsu.edu), Industrial Design

**Professors:** S. D. Brandeis, V. M. Foote, C. E. Joyner, H. Khachatoorian, 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

## Industrial Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Industrial Engineering</u></a>	Y		Y		Y		

### GRADUATE FACULTY

P. H. Cohen, *Department Head*

#### *Director of Graduate Programs:*

R. E. King, Box 7906, 515.5186, [king@ncsu.edu](mailto:king@ncsu.edu), Industrial Engineering

*Clifton A. Anderson Distinguished Professor:* R. Uzsoy

*Edgar S. Woolard Distinguished Professor and Dept. Head:* P. H. Cohen

*Henry A. Foscue Professor of Industrial Engineering and Furniture Manufacturing:* C. T. Culbreth, Jr.

*James T. Ryan Professor and Distinguished University Professor:* 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, Y. Fathi, D. B. Kaber, R. E. King, Y. Lee, 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, O. Harrysson, S. M. Hsiang, S. D. Jackson, 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, J. Taheri; *Assistant Professors:* B. T. Denton, J. Dong, 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 of the Edward P. Fitts Department of Industrial and Systems Engineering supports academic and research interests in four areas: (1) manufacturing systems (manufacturing processes, medical device manufacturing systems, CAM, CIM, robotics, automation, rapid prototyping and concurrent engineering); (2) production systems (logistics systems, supply chain management, scheduling, inventory control, materials handling, facility design, furniture manufacturing and management, quality control, and engineering economics); (3) systems analysis and optimization (health systems, stochastic processes, simulation, mathematical programming, and soft computing); and (4) 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 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

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

ISE(PSY) 744 Human Information Processing  
 ISE(PSY) 745 Human Performance Modeling  
 ISE 748 Quality Engineering  
 ISE 749 Tolerances in Design and Manufacturing  
 ISE 750 Concurrent Engineering  
 ISE 751 Modeling Imprecision in Design and Manufacturing  
 ISE 753 Material Handling Systems  
 ISE 754 Logistics Engineering  
 ISE 755 The Just-in-time Production System  
 ISE(CSC) 756 Advances in Voice Input/Output Communications Systems  
 ISE 759 Constraint Modeling of Manufacturing Systems  
 ISE 760 Applied Stochastic Models in Industrial Engineering  
 ISE(OR) 761 Queues and Stochastic Service Systems  
 ISE(CSC,OR) 762 Computer Simulation Techniques  
 ISE(MA,OR) 766 Network Flows  
 ISE 767 Upper Extremity Biomechanics  
 ISE 768 Spine Biomechanics  
 ISE(OR) 772 Stochastic Simulation Design and Analysis  
 ISE 789 Advanced Special Topics in Industrial Engineering  
 ISE 790 Advanced Special Topics in Systems Analysis and Optimization  
 ISE 791 Advanced Special Topics in Manufacturing  
 ISE 793 Advanced Special Topics in Production  
 ISE 794 Advanced Problems in Ergonomics  
 ISE 796 Research Practicum in Occupational Biomechanics  
 ISE 801 Seminar  
 ISE(PSY) 802 Area Seminar in Ergonomics  
 ISE 803 Seminar in Product Safety and Liability  
 ISE 804 Seminar in Applied Ergonomics  
 ISE(MA,OR) 812 Special Topics in Mathematical Programming  
 ISE 815 Advanced Special Topics in Industrial Engineering  
 ISE(MA,OR) 816 Advanced Special Topics in Systems Analysis and Optimization  
 ISE 817 Advanced Special Topics in Manufacturing  
 ISE 818 Advanced Special Topics in Production  
 ISE 837 Directed Study in Industrial Engineering  
 ISE 839 Advanced Directed Study in Industrial Engineering  
 ISE 861 The Design of Production Systems  
 ISE(OR) 862 Scheduling and Routing  
 ISE 877 Industrial Engineering Projects  
 ISE 885 Doctoral Supervised Teaching  
 ISE 890 Doctoral Preliminary Examination  
 ISE 893 Doctoral Supervised Research  
 ISE 895 Doctoral Dissertation Research  
 ISE 896 Summer Dissertation Research  
 ISE 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
<a href="#"><u>Integrated Manufacturing Systems Engineering</u></a>					Y		



## GRADUATE FACULTY

### *Director of Graduate Programs:*

S. D. Jackson, Box 7915, 515.3808, [steve\\_jackson@imsei.ncsu.edu](mailto: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. Foscoe Professor of Industrial Engineering and Furniture Manufacturing:* C. T. Culbreth, Jr.

*James T. Ryan Professor and Distinguished University Professor:* 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, 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, O. Harrysson, G. L. Hodge, S. D. Jackson, M. G. Kay, K. Mitchell, M. K. Ramasubramanian, E. T. Sani; **Adjunct Associate Professors:** J. Taheri; **Assistant Professors:** B. T. Denton, J. S. Ivy, E. A. Sumner III, D. Warsing; **Adjunct Assistant Professors:** J. A. Janet

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)**

<b>Area 1</b>	CSC 510 - Software Engineering CSC 742 - Database Management Systems ISE(CSC,OR) 762 - Computer Simulation Techniques ISE(CSC) 441 - Introduction to Simulation ISE 719 - CIM System Design
<b>Area 2</b>	BUS 520 - Managerial Finance ISE 510 - Applied Engineering Economy ISE 711 - Capital Investment Economic Analysis
<b>Area 3</b>	ISE 514 - Manufacturing Product Engineering ISE 707 - Real-time Control of Automated Manufacturing ISE 715 - Manufacturing Process Engineering ISE 716 - Automated Systems Engineering
<b>Area 4</b>	ISE 723 - Production Planning, Scheduling and Inventory Control
<b>Area 5</b>	MAE(WPS) 534 - Mechatronic Design MAE 742 - Mechanical Design for Automated Assembly

**II. Logistics Core (one from each area)**

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

**III. Mechatronics Core (one from each area)**

<b>Area 1</b>	MAE (WPS) 534 - Mechatronic Design ECE 556 - Agent-Based Mechatronics Systems
<b>Area 2</b>	MAE 513 - Principles of Structural Vibration MAE 533 - Finite Element Method I MAE 742 – Mechanical Design for Automated Assembly
<b>Area 3</b>	ECE 511 - Analog Electronics ECE 555 - Computer Control of Robots ECE 561 - Embedded Systems Design
<b>Area 4</b>	CSC(ECE) 517 - Object-oriented Languages and Systems ISE 716 - Automated Systems Engineering; I E 719 - CIM System Design
<b>Area 5</b>	ECE 742 - Artificial Neural Networks MAE 524 - Principles of Mechatronic Control

#### IV. Biomanufacturing Core (one from each area)

<b>Area 1</b>	CSC 510 - Software Engineering CSC 742 - Database Management Systems ISE 719 - CIM Systems Design
<b>Area 2</b>	BUS 520 - Managerial Finance ISE 711 - Capital Investment Economic Analysis
<b>Area 3</b>	ISE 514 - Manufacturing Product Engineering ISE 589 - Special Topics (Engineering Project Management )
<b>Area 4</b>	ISE 789 - Special Topics (Quality Engineering in Biomedical Applications)
<b>Area 5</b>	ISE 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

### International Studies

#### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">International Studies</a>					Y		

#### GRADUATE FACULTY

##### *Director of Graduate Programs:*

H. H. Hobbs, Box 8102, 513.4389, [heidi\\_hobbs@ncsu.edu](mailto:heidi_hobbs@ncsu.edu), International Studies

*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; **Professors Emeriti:** C. H. Carlton, E. W. Erickson, M. S. Soroos, M. A. Witt Frese; **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; **Adjunct Assistant Professors:** T. E. Ray

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 Ec 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 as determined by the Department of Foreign Languages and Literatures (FLL).

**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
<a href="#">Landscape Architecture</a>					Y		

## GRADUATE FACULTY

G. Bressler, *Department Head*

### *Director of Graduate Programs:*

F. H. Magallanes, Box 7701, 515.8348, [f\\_magallanes@ncsu.edu](mailto: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, S. Hatchell, M. Jennings, 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

## Liberal Studies

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Liberal Studies</a>				Y			

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

M. D. Garval, Box 7107, 515.9276, [garval@social.chass.ncsu.edu](mailto:garval@social.chass.ncsu.edu), Liberal Studies

*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 four to five page statement

describing their objectives in doing a degree in liberal studies and a resume. GRE scores are not required. All applicants are interviewed.

**Master's Degree Requirements:** Thirty hours of course work made up of (1) three MALS seminars or two MALS seminars and a research methods course, (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.

## 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

## Marine, Earth and Atmospheric Sciences

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Marine, Earth, and Atmospheric Sciences</u></a>	Y		Y				

## GRADUATE FACULTY

J. C. Fountain, *Department Head*

### Director of Graduate Programs:

G. S. Janowitz, Box 8208, 515.7837, [janowitz@ncsu.edu](mailto: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, D. P. Genereux, J. P. Hibbard, G. S. Janowitz, D. Kamykowski, E. L. Leithold, D. McConnell, 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:** R. He, M. M. Kimberley, G. M. Lackmann, H. Mitsova, M. H. Schweitzer, P. Shaw, W. J. Showers, S. Yuter, Y. Zhang; **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. Aiyer, D. R. Bohnenstiehl, R. P. Boyles, J. A. Clarke, J. Liu, N. Meskhidze, C. Osburn, M. Parker, K. Wegmann; **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, J. M. Morrison, 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 572 Paleontological Methods  
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 572 Paleontological Methods  
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

## Materials Science and Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Materials Science and Engineering</u></a>	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](mailto: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, M. A. L. Johnson, J. Kasichainula, J. Maria, Y. T. Zhu; *Research Associate Professors:* A. Batchelor, 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:* D. Irving, T. M. Luo, C. L. Reynolds Jr., J. B. Tracy, Y. G. Yingling; *Research Assistant Professors:* R. R. Collazo, D. J. Lichtenwalner, T. A. Rawdanowicz

### 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 555 Polymer Technology and Engineering  
MSE 556 Composite Materials  
MSE 560 Microelectronic Materials Science and Technology  
MSE(TC) 561 Organic Chemistry of Polymers  
MSE(MBA) 576 Technology Evaluation and Commercialization Concepts  
MSE(MBA) 577 High Technology Entrepreneurship  
MSE(MBA) 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 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 708 Thermodynamics of Materials  
MSE 710 Elements of Crystallography and Diffraction  
MSE 712 Scanning Electron Microscopy  
MSE 715 Transmission Electron Microscopy  
MSE(MAE) 731 Materials Processing by Deformation  
MSE(MAE) 732 Fundamentals of Metal Machining Theory  
MSE 751 Thin Film and Coating Science and Technology I  
MSE 752 Thin Film and Coating Science and Technology II

MSE(NE) 757 Radiation Effects on Materials  
 MSE 760 Materials Science Processing for Semiconductor Devices  
 MSE(CHE) 761 Polymer Blends and Alloys  
 MSE 770 Defects, Diffusion and Ion Implantation in Semi-conductors  
 MSE 771 Materials Science of Nanoelectronics  
 MSE 775 Structure of Semicrystalline Polymers  
 MSE 791 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

## Mathematics

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Applied Mathematics</a>	Y		Y				
<a href="#">Mathematics</a>	Y		Y				

### GRADUATE FACULTY

A. G. Helminck, *Interim Department Head*

#### Director of Graduate Programs:

S. L. Campbell, Box 8205, 515.3300, [s\\_campbell@ncsu.edu](mailto:s_campbell@ncsu.edu), Mathematics

*Distinguished University Professor and Drexel Professor:* H. T. Banks

*Professors:* S. L. Campbell, M. T. Chu, E. N. Chukwu, L. O. Chung, J. D. Cohen, A. C. Fauntleroy, J. E. Franke, R. O. Fulp, P. A. Gremaud, R. E. Hartwig, A. G. Helminck, H. Hong, I. Ipsen, K. Ito, N. Jing, E. L. Kaltofen, C. T. Kelley, A. Kheyfets, T. J. Lada, Z. Li, X. Lin, S. R. Lubkin, R. H. Martin Jr., N. G. Medhin, C. D. Meyer Jr., K. C. Misra, M. S. Putcha, S. Schecter, J. F. Selgrade, M. Shearer, C. E. Siewert, J. W. Silverstein, M. F. Singer, R. C. Smith, E. L. Stitzinger, H. T. Tran, R. E. White; *Adjunct Professors:* R. L. Ives, E. M. Peck, P. M. Schlosser; *Professors Emeriti:* J. W. Bishir, E. E. Burniston, R. E. Chandler, J. M. Danby, J. C. Dunn, K. Koh, J. Luh, J. A. Marlin, L. B. Martin Jr., P. A. Nickel, C. Pao, R. A. Struble; *Associate Professors:* A. Chertock, M. A. Haider, A. L. Lloyd, L. K. Norris, M. Olufsen, S. O. Paur, J. Rodriguez, J. S. Scroggs, S. V. Tsynkov, D. Zenkov; *Associate Professors Emeriti:* G. D. Faulkner, D. E. Garoutte, L. B. Page, R. T. Ramsay, R. Silber, D. F. Ullrich; *Assistant Professors:* B. Bakalov, H. J. Charlton, P. Hersh, M. Kang, I. Kogan, D. LaBate, T. Pang, N. Reading, K. Sivaramakrishnan, S. Sullivant, A. Szanto; *Adjunct Assistant Professors:* V. Novak; *Assistant Professors Emeriti:* D. J. Hansen

### ASSOCIATE MEMBERS OF THE PROGRAM

*Professors:* F. H. M. Semazzi; *Associate Professors:* J. D. Brown

The Department of Mathematics offers programs leading to the degrees of Master of Science and Doctor of Philosophy in mathematics and in applied mathematics. Students may opt for the concentration in computational mathematics, which is attached to the program in applied mathematics. The Concentration in Interdisciplinary Mathematics (MAI) is available to Ph.D. students in either Mathematics or Applied Mathematics. It is not available to Masters Students. Through the Center for Research in Scientific Computation, which is housed in the Department of Mathematics, students may participate in the

industrial applied mathematics program, a program of joint research endeavors with industrial and governmental partners.

**Admissions Requirements:** Applicants for admission should have an undergraduate or Master's degree in mathematics or the equivalent. This should include courses in advanced calculus, modern algebra and linear algebra. Applicants with degrees in other subjects may be admitted but may be required to take certain undergraduate courses in mathematics without receiving graduate credit. The GRE Advanced Test in Mathematics is not required but a good score can be a positive factor in admission.

**Master of Science Requirements:** The M.S. degree requires a minimum of 30 credit hours. In addition to course requirements (27 credit hours), the M.S. degree requires a written Master's project for 3 hours credit.

**Ph.D. Requirements:** The Ph.D. requires a minimum of 72 credit hours. A student will typically take 50-60 semester hours of course credits for the Ph.D. These courses include one semester of modern algebra and one semester of mathematical analysis. The written preliminary examination consists of examinations in three areas of mathematics. These are chosen by the student from 14 possibilities. The research dissertation should represent a substantial contribution to an area of mathematics or its applications.

**Student Financial Support:** Teaching assistantships and some research assistantships are available. Teaching assistants benefit from a structured program of training in university-level teaching.

**Other Information:** The Department of Mathematics has a large number of workstations devoted exclusively to its graduate students.

## GRADUATE COURSES

MA 501 Advanced Mathematics for Engineers and Scientists I  
MA 502 Advanced Mathematics for Engineers and Scientists II  
MA(OR) 504 Introduction to Mathematical Programming  
MA(ISE,OR) 505 Linear Programming  
MA 507 Analysis for Secondary Teachers  
MA 508 Geometry for Secondary Teachers  
MA 509 Abstract Algebra for Secondary Teachers  
MA 510 Selected Topics in Mathematics for Secondary Teachers  
MA 511 Advanced Calculus I  
MA 512 Advanced Calculus II  
MA 513 Introduction to Complex Variables  
MA 515 Analysis I  
MA 518 A First Course in Differential Geometry  
MA 520 Linear Algebra  
MA 521 Abstract Algebra I  
MA 522 Computer Algebra  
MA 523 Linear Transformations and Matrix Theory  
MA(E,OR) 531 Dynamic Systems and Multivariable Control I  
MA 532 Ordinary Differential Equations I  
MA 534 Introduction to Partial Differential Equations  
MA 535 Stability and Time Optimal Control of Hereditary Systems I  
MA 537 Nonlinear Dynamics and Chaos  
MA 544 Computer Experiments in Mathematical Probability  
MA(ST) 546 Probability and Stochastic Processes I  
MA 547 Financial Mathematics  
MA 551 Introduction to Topology  
MA 555 Introduction to Manifold Theory  
MA 561 Set Theory and Foundations of Mathematics  
MA(CSC,OR) 565 Graph Theory  
MA(BMA) 573 Mathematical and Experimental Modeling of Physical Processes I  
MA 574 Mathematical and Experimental Modeling of Physical Processes II  
MA(PY) 575 Mathematical Introduction to Celestial Mechanics  
MA(PY) 576 Orbital Mechanics

MA(CSC) 580 Numerical Analysis I  
 MA(CSC) 583 Introduction to Parallel Computing  
 MA 584 Numerical Solution of Partial Differential Equations - Finite Difference Methods  
 MA 587 Numerical Solution of Partial Differential Equations - Finite Element Method  
 MA 591 Special Topics  
 MA 676 Master's Project  
 MA 685 Master's Supervised Teaching  
 MA 688 Non-Thesis Master's Continuous Registration - Half-Time Registration  
 MA 689 Non-Thesis Master's Continuous Registration - Full-Time Registration  
 MA 690 Master's Examination  
 MA 693 Master's Supervised Research  
 MA 695 Master's Thesis Research  
 MA 696 Summer Thesis Research  
 MA 699 Master's Thesis Preparation  
 MA(ST,OR) 706 Nonlinear Programming  
 MA(ISE,OR) 708 Integer Programming  
 MA 711 Analytic Function Theory I  
 MA 712 Analytic Function Theory II  
 MA 713 Techniques of Complex Analysis  
 MA 715 Analysis II  
 MA 716 Advanced Functional Analysis  
 MA(OR) 719 Vector Space Methods in System Optimization  
 MA 720 Lie Algebras  
 MA 721 Abstract Algebra II  
 MA 722 Computer Algebra II  
 MA 723 Theory of Matrices and Applications  
 MA 725 Lie Algebra Representation Theory  
 MA(E,OR) 731 Dynamic Systems and Multivariable Control II  
 MA 732 Ordinary Differential Equations II  
 MA 734 Partial Differential Equations  
 MA 735 Stability and Time Optimal Control of Hereditary Systems II  
 MA(ST) 746 Introduction to Stochastic Processes  
 MA(ST) 747 Probability and Stochastic Processes II  
 MA(ST) 748 Stochastic Differential Equations  
 MA 751 Topology  
 MA 753 Algebraic Topology  
 MA 755 Introduction to Riemannian Geometry  
 MA 756 Geometrical Structures on Fiber Bundles  
 MA(ISE,OR) 766 Network Flows  
 MA(BMA,ST) 771 Biomathematics I  
 MA(BMA,ST) 772 Biomathematics II  
 MA(BMA,OR,ST) 773 Stochastic Modeling  
 MA 775 Mathematical Methods in the Physical Sciences I  
 MA 776 Mathematical Methods in the Physical Sciences II  
 MA(ST) 778, 779 Measure Theory and Advanced Probability  
 MA(CSC) 780 Numerical Analysis II  
 MA 782 Advanced Numerical Linear Algebra  
 MA(CSC) 783 Parallel Algorithms and Scientific Computation  
 MA 784 Nonlinear Equations and Unconstrained Optimization  
 MA 785 Numerical Solution of Ordinary Differential Equations  
 MA 788 Numerical Nonlinear Partial Differential Equations  
 MA(IE,OR) 790 Advanced Special Topics in System Optimization  
 (The subject matter in the following special topics courses varies from year to year. The topics and instructors are announced well in advance by the department.)  
 MA 791 Special Topics in Real Analysis  
 MA 792 Special Topics in Algebra  
 MA 793 Special Topics in Differential Equations  
 MA 795 Special Topics in Topology

MA 796 Special Topics in Combinatorial Analysis  
 MA 797 Special Topics in Applied Mathematics  
 MA 798 Special Topics in Numerical Analysis  
 MA(OE,OR) 812 Special Topics in Mathematical Programming  
 MA(ISE,OR) 816 Advanced Special Topics in Systems Analysis and Optimization  
 MA 885 Doctoral Supervised Teaching  
 MA 890 Doctoral Preliminary Examination  
 MA 893 Doctoral Supervised Research  
 MA 895 Doctoral Dissertation Research  
 MA 896 Summer Dissertation Research  
 MA 899 Doctoral Dissertation Preparation

## Mathematics, Science and Technology Education

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Mathematics Education</a>	Y		Y			Y	
<a href="#">Science Education</a>	Y		Y			Y	
<a href="#">Technology Education</a>		Y	Y			Y	

### GRADUATE FACULTY

J. E. Penick, *Department Head*

#### *Directors of Graduate Programs:*

E. N. Wiebe, Box 7801, 515.1753, [eric\\_wiebe@ncsu.edu](mailto:eric_wiebe@ncsu.edu), Science Education  
 H. S. Lee, Box 7801, 513.3544, [hollylynn@ncsu.edu](mailto:hollylynn@ncsu.edu), Mathematics Education  
 V. W. DeLuca, Box 7801, 515.1750, [william\\_deluca@ncsu.edu](mailto:william_deluca@ncsu.edu), Technology Education

*Moore Distinguished Professor:* J. Confrey

**Professors:** S. B. Berenson, W. J. Haynie III, M. G. Jones, J. E. Penick, L. V. Stiff, P. Sztajn; **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, H. S. Lee, K. S. Norwood, J. C. Park, J. H. Wheatley, E. N. Wiebe; **Research Associate Professors:** H. S. Stubbs; **Adjunct Associate Professors:** T. Oppewal; **Associate Professors Emeriti:** R. E. Peterson, 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, B. Matthews, A. McCulloch, E. Parsons, T. E. Varnado; **Visiting Assistant Professors:** G. Holley, 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. We prepare educators for positions as teachers, as leaders, and as university faculty of the highest quality. We are particularly proud of our emphasis on the use of technology to enhance teaching. 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.

Doctoral programs enroll students who are knowledge-seekers and are eager to pursue educational problems and develop critical thinking skills in a collaborative environment. The programs prepare individuals to be knowledgeable about and prepared to accept positions related to:

1. scholarly inquiry and discourse in their discipline,
2. preparation of K-12 teachers,
3. instruction and development issues in K-16, and
4. leadership positions.

**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 may be able to substitute up to six semester hours of thesis research for part of the course load.

**Doctoral Degree Requirements:** The Ed.D. program in Technology Education 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 in Mathematics Education requires a minimum of 50 semester hours of course work and 12 semester hours of dissertation research beyond the Master's Degree requirements. The Ph.D. program in Science Education requires a minimum of 48 semester hours of course work and 9 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. Please discuss these opportunities directly with program area faculty.

## GRADUATE COURSES

EMS 501 Readings in Science Education I  
EMS 502 Readings in Science Education II  
EMS 505 Methods of Teaching Science I  
EMS 506 Methods of Teaching Science 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 Methods and Materials for Teaching Mathematics  
EMS 572 Teaching Mathematics Topics in Senior High School  
EMS 573 Technology Tools for Science Teaching  
EMS 575 Foundations of Science Education  
EMS 577 Improving Classroom Instruction in Science  
EMS 580 Teaching Mathematics with Technology  
EMS 581 Advanced Applications of Technology in Mathematics Education  
EMS 592 Special Problems in Mathematics Teaching  
EMS 594 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 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 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

## Mechanical and Aerospace Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Aerospace Engineering</a>	Y		Y				
<a href="#">Mechanical Engineering</a>	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](mailto: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, A. V. Kuznetsov, J. W. Leach, K. M. Lyons, 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., 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, R. R. Johnson, 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. Echehki, J. W. Eischen, A. Gopalathnam, C. E. Hall Jr., E. C. Klang, H. Luo, A. P. Mazzoleni, A. Rabiei, M. K. Ramasubramanian, A. Saveliev, S. Seelecke, F. Wu; **Research Associate Professors:** Z. Zhang; **Adjunct Associate Professors:** J. H. Hebrank, G. A. Truskey; **Assistant Professors:** T. Fang, S. Ferguson, G. Ngaile, K. J. Peters, S. Terry, T. Ward, Y. Zhu; **Visiting Assistant Professors:** A. O. Hobbs; **Adjunct Assistant Professors:** J. A. Cooke, P. A. Cooper

The **Mechanical Engineering** graduate program prepares students in all aspects of mechanical and thermal systems design and manufacturing. Course offerings and research programs for mechanical engineering students are available in applied mechanics; biomechanics; combustion; design and manufacturing: dynamic systems and control; energy conversion and systems; experimental mechanics; fluid dynamics; heat transfer; mechanics of materials; micro, nano and MEMS; and vibration and acoustics. Sub-areas include adaptive and auto adaptive structures, controls and system identification, CFD, energy conversion and renewable energy, materials processing and tribology, mechatronics, precision engineering, and reactive and multiphase flows.

Graduate students in the **Aerospace Engineering** program focus on aircraft and space systems design, analysis, and manufacturing. Students can select course offerings and research programs in aerodynamics and applied aerodynamics; aerospace propulsion; computational fluid dynamics; dynamics and design of spacecraft and space systems; flight dynamics and control; and multifunctional materials and smart structures. Sub-areas include acoustics, aeroelasticity, atomization, sprays, composite materials, reactive and multiphase flows, stability, and transition to turbulence.

**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. A direct path to the Ph.D. from the B.S. is also available with which the student is granted the M.S. degree "enroute" to the Ph.D.

**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 522 Non Linear System Analysis and Control  
MAE 524 Principles of Mechatronic 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 581 Space Flight Orbital Mechanics  
 MAE 582 Spacecraft Attitude Dynamics and Control I  
 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 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 Modern 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 782 Spacecraft Attitude Dynamics and Control II  
 MAE 783 Space Flight Guidance and Navigation  
 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
<a href="#">Microbial Biotechnology</a>					Y		
<a href="#">Microbiology</a>	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](mailto: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, P. Arasu, D. T. Brown, F. J. Fuller, L. Jaykus, P. E. Orndorff, B. Sherry, J. C. H. Shih; **Professors Emeriti:** W. E. Kloos; **Associate Professors:** 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 Biology of Plant Pathogens  
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(PP) 715 Applied Evolutionary Analysis of Population Genetic Data  
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

## Natural Resources

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Natural Resources</a>			Y		Y		

### GRADUATE FACULTY

#### *Directors of Graduate Programs:*

F. H. Magallanes, Box 7701, 515.8348, [f\\_magallanes@ncsu.edu](mailto:f_magallanes@ncsu.edu), Landscape Architecture  
J. C. Peel, Box 8004, 515.3663, [judy\\_peel@ncsu.edu](mailto:judy_peel@ncsu.edu), Parks, Recreation & Tourism Mgmt.  
S. T. Warren, Box 8008, 515.7996, [sarah\\_warren@ncsu.edu](mailto:sarah_warren@ncsu.edu), Forestry  
T. J. Smyth, Box 7619, 515.2838, [jot\\_smyth@ncsu.edu](mailto:jot_smyth@ncsu.edu), Soil Science

**Professors:** R. C. Abt, A. Amoozegar, D. H. Anderson, 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, T. J. Smyth, M. J. Vepraskas, M. G. Waggoner, W. E. Winner; **Associate Professors:** A. Attarian, G. B. Blank, B. P. Bullock, H. Cheshire, L. D. Gustke, G. R. Hess, Y. Leung, F. H. Magallanes, R. L. Moore, C. E. Moorman, S. A. C. Nelson, T. H. Shear, E. O. Sills, T. A. Steelman, S. T. Warren; **Research Associate Professors:** P. K. Baran; **Assistant Professors:** A. James, M. N. Peterson

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 (10 credit hours)

NR 500 Natural Resource Management  
NR 571 Current Issues in Natural Resource Policy  
ST 5\*\* Graduate-level statistics course  
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

## Nuclear Engineering

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Nuclear Engineering</a>	Y		Y		Y		

## GRADUATE FACULTY

Y. R. Azmy, *Department Head*

### Director of Graduate Programs:

K. L. Murty, Box 7909, 515.3657, [murty@ncsu.edu](mailto:murty@ncsu.edu), Nuclear Engineering

**Professors:** Y. R. Azmy, 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:** D. Y. Anistratov, J. M. Doster, A. I. Hawari, S. Shannon, M. S. Yim; **Adjunct Associate Professors:** B. W. Wieland; **Assistant Professors:** J. Eapen; **Visiting Assistant Professors:** H. S. Abdel-Khalik; **Adjunct Assistant Professors:** A. Sood; **Interinstitutional Faculty:** D. N. McNeilis

## ASSOCIATE MEMBERS OF THE PROGRAM

**Professors:** V. C. Matzen; **Associate Professors:** A. Gupta, T. Hassan

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 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. NE 721 and NE 727 courses are 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(MSE) 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 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
<a href="#">Nutrition</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

J. C. Allen, Box 7624, 513.2257, [jon\\_allen@ncsu.edu](mailto: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, K. E. Anderson, L. C. Boyd, L. S. Bull, G. L. Catignani, W. J. Croom Jr., P. C. Dunn, J. H. Eisemann, P. R. Ferket, J. L. Grimes, W. M. Hagler Jr., B. A. Hopkins, C. J. Lackey, J. Luginbuhl, J. W. McClelland, J. F. Ort, M. H. Poore, J. C. H. Shih, R. C. Smart, J. W. Spears, L. W. Whitlow; ***Professors Emeriti:*** B. P. Alston-Mills, 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, S. W. Kim, J. A. Moore, P. E. Mozdziak, P. D. Siciliano, E. van Heugten; ***Adjunct Associate Professors:*** R. J. Harrell; ***Assistant Professors:*** G. K. Harris, M. Martin, 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(FS) 510 Food Lipids: Issues and Controversies  
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(ANS) 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

# Operations Research

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Operations Research</a>	Y		Y		Y		

## GRADUATE FACULTY

### *Director of Graduate Programs:*

Y. Fathi, Box 7913, 515.6417, [fathi@eos.ncsu.edu](mailto:fathi@eos.ncsu.edu), Operations Research

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

*Bank of America University Distinguished Professor:* R. B. Handfield

*Clifton A. Anderson Distinguished Professor:* R. Uzsoy

*James T. Ryan Professor and Distinguished University Professor:* 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, 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, M. P. Singh, R. C. Smith, M. F. M. Stallmann, 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, D. M. Holthausen Jr., H. L. Nuttle; *Associate Professors:* K. T. Barletta, R. Y. Chirkova, S. Ghosal, T. L. Honeycutt, S. M. Hsiang, J. A. Joines, M. G. Kay, T. W. Reiland, C. E. Smith, W. Wang, F. Wu, D. Zenkov; *Adjunct Associate Professors:* J. Taheri; *Assistant Professors:* B. T. Denton, J. S. Ivy, T. Pang, K. Sivaramakrishnan, D. Warsing, T. Yu

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(ISE,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(ISE,MA) 708 Integer Programming  
 OR(ISE) 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(ISE) 726 Theory of Activity Networks  
 OR(E,MA) 731 Dynamic Systems and Multivariable Control II  
 OR(ISE) 760 Applied Stochastic Models in Industrial Engineering  
 OR(ISE) 761 Queues and Stochastic Service Systems  
 OR(CSC,ECE,ISE) 762 Computer Simulation Techniques  
 OR(ISE,MA) 766 Network Flows  
 OR(ISE) 772 Stochastic Simulation Design and Analysis  
 OR(BMA,MA,ST) 773 Stochastic Modeling  
 OR(BMA) 774 System Modeling Theory  
 OR(ISE,MA) 790 Advanced Special Topics in Systems Analysis and Optimization  
 OR 791 Advanced Special Topics  
 OR 801 Seminar  
 OR 810 Special Topics  
 OR(ISE,MA) 812 Special Topics in Mathematical Programming  
 OR 815 Advanced Special Topics  
 OR(ISE,MA) 816 Advanced Special Topics in System Optimization  
 OR 852 Practicum in Operations Research  
 OR(ISE) 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  
 CE 775 Modeling and Analysis of Environmental Systems  
 CHE 525 Chemical Process Control  
 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 516 System Control Engineering  
 ECE 521 Digital Computer Technology and Design  
 ECG (ST) 561 Intermediate Econometrics  
 ECG 750 Economic Decision Theory  
 ECG(ST) 751 Econometrics  
 ECG(ST) 752 Topics in Econometrics  
 ISE 723 Production Planning, Scheduling and Inventory Control  
 ISE 747 Reliability Engineering  
 ISE 748 Quality Engineering  
 ISE 861 The Design of Production Systems  
 MA 515 Analysis I  
 MA 523 Linear Transformations and Matrix Theory  
 MA(ST) 546 Theory of Probability  
 MA(CSC) 580, 780 Numerical Analysis I, II  
 MA 715 Functional Analysis I  
 MA 716 Advanced Functional Analysis  
 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 515, 516 Experimental Statistics for Engineers I, II  
 ST 730 Applied Time Series Analysis  
 ST 782, 783 Time Series Analysis I, II  
 ST 785 Introduction to Statistical Decision Theory

## Parks, Recreation and Tourism Management

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#"><u>Parks, Recreation, and Tourism Management</u></a>	Y		Y		Y		

### GRADUATE FACULTY

D. H. Anderson, *Department Head*

#### *Director of Graduate Programs:*

J. C. Peel, Box 8004, 515.3663, [judy\\_peel@ncsu.edu](mailto:judy_peel@ncsu.edu), Parks, Recreation & Tourism Mgmt.

**Professors:** D. H. Anderson, H. A. Devine, M. F. Floyd, K. A. Henderson, J. C. Peel, C. D. Siderelis, J. D. Wellman;

**Professors Emeriti:** P. S. Rea; **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; **Assistant Professors:** J. Bocarro, J. Casper, H. Grappendorf, M. G. Harrolle, E. Lindsay, S. Rozier, S. R. Tomas, R. W. Wade

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 March 15 for U.S. students; February 15 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 February 15 for U.S. students, January 15 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 660 Professional Practicum  
PRT 665 Professional Project  
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
<a href="#">Physics</a>	Y		Y				

### GRADUATE FACULTY

M. A. Paesler, *Department Head*

#### *Director of Graduate Programs:*

H. Ade, Box 8202, 515.8706, [harald\\_ade@ncsu.edu](mailto: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, P. Huffman, C. R. Ji, J. Krim, L. Mitas, J. R. Mowat, M. A. Paesler, S. P. Reynolds, J. S. Risley, C. M. Roland, T. Schaefer, A. R. Young; **Research Professors:** B. Fortner, R. Golub, J. E. Rowe; **Visiting Professors:** J. L. Hubisz; **Adjunct Professors:** R. Nemanich, C. R. Philbrick; **Professors Emeriti:** K. T. Chung, J. W. Cook Jr., 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, J. F. Schetzina, L. W. Seagondollar, P. J. Stiles, D. R. Tilley; **Associate Professors:** J. D. Brown, M. Buongiorno-Nardelli, D. J. Lee, G. McLaughlin, M. C. Sagui; **Research Associate Professors:** K. J. Borkowski; **Adjunct Associate Professors:** P. E. Garrett; **Associate Professors Emeriti:** G. C. Cobb Jr., G. W. Parker III; **Assistant Professors:** L. I. Clarke, K. Daniels, T. P. Pearl, R. Riehn, K. R. Weninger; **Research Assistant Professors:** J. Bochinski, J. H. Kelley, W. Lu

### ASSOCIATE MEMBERS OF THE PROGRAM

**Professors:** R. M. Kolbas, Z. Sitar; **Associate Professors:** 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), GRE, 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; passing of written and oral preliminary exam and final oral defense.

**Student Financial Support:** Graduate teaching assistantships are available for new and continuing students; research assistantships are available to continuing students and occasionally to new students. More than 95% of students are supported by assistantships.

## 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 581 Matter and Interactions for Teachers I  
PY 582 Matter and Interactions for Teachers II  
PY 590 Special Topics in Physics  
PY 599 Special Topics in Physics  
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
<a href="#">Physiology</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

M. C. Roberts, Box 8401, 513.6248, [malcolm\\_roberts@ncsu.edu](mailto: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, K. E. Anderson, B. L. Black, R. J. Borski, D. C. Dorman, F. W. Edens, K. L. Esbenshade, C. E. Farin, W. L. Flowers, J. E. Gadsby, R. M. Grossfeld, H. F. Heatwole, S. L. Pardue, J. N. Petite, 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, T. E. LeVere, J. F. Roberts; *Associate Professors:* A. T. Blikslager, B. A. Breuhaus, P. W. Farin, P. E. Mozdziak, M. Schramme, C. S. Whisnant, M. D. Whitacre; *Assistant Professors:* T. Ghashghaei, J. Gookin, B. J. Grubb, M. E. Hockett, J. L. Lubischer, A. J. Moeser, S. E. Pratt, M. Rodriguez-Puebla, G. Smith

### ASSOCIATE MEMBERS OF THE PROGRAM

*Assistant Professors:* M. Koci

The Physiology Graduate Program is an interdisciplinary and interdepartmental program comprising faculty drawn from the College of Veterinary Medicine and the College of Agriculture and Life Sciences (including departments of animal science, biochemistry, clinical sciences, entomology, molecular and biomedical sciences, population health and pathobiology, poultry science, psychology, and zoology). An advanced degree in physiology is highly valued by the scientific community and can lead to careers in research and teaching in academia, industry and government laboratories, public policy and consulting. Research is carried out using a variety of model organisms, laboratory and companion and agriculturally important species.

**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 (at least 1000; combined verbal and quantitative), 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 Physiology Seminar  
PHY(ZO) 602 Seminar in Biology of Reproduction  
PHY 610 Special Topics in Physiology  
PHY 620 Special Problems in Physiology  
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 Physiology Seminar  
PHY(ANS,CBS,ZO) 802 Seminar in Biology of Reproduction  
PHY 810 Special Topics in Physiology  
PHY 820 Special Problems in Physiology  
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

## Recommended Courses Normally Included in Programs of Study for the M.S. and Ph.D. Degrees and the Non-Thesis MOP Program

Other recommended/supporting courses are available through many departments, e.g. animal science, biochemistry, biomathematics, biotechnology, cell biology, comparative biomedical sciences, entomology, genetics, immunology, microbiology, nutrition, pharmacology, poultry science, psychology, statistics, toxicology, and zoology, and may be included for consideration in the plan of work.

## Plant Biology

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Plant Biology</a>	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](mailto:rebecca_boston@ncsu.edu), Plant Biology

*Distinguished University Professor:* W. F. Thompson

*Named Professor of Botany:* J. M. Burkholder

*William Neal Reynolds Distinguished Professor:* W. F. Boss

*William Neal Reynolds Professor:* R. S. Boston

*William Neal Reynolds Professor and Head of Botany Department:* M. E. Daub

*Professors:* R. L. Blanton, C. S. Brown, C. H. Haigler, T. L. Lomax, D. Robertson, J. M. Stucky, T. R. Wentworth;

*Professors Emeriti:* N. S. Allen, 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. F. Thomas, J. R. Troyer, C. G. Van Dyke; *Associate Professors:* R. L. Beckmann, J. E. Mickle, Q. Xiang; *Assistant Professors:* S. B. Carson, W. A. Hoffmann, C. Jordan, A. Krings, H. I. A. Sederoff, D. Xie; *Research Assistant Professors:* I. Y. Perera

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, chemical genomics.

**Admission Requirements:** Students entering the graduate program in plant biology should have a bachelor's degree in plant biology or a related undergraduate program that includes biological, physical and mathematical science training including undergraduate courses in organic chemistry, calculus and genetics, as well as biology. All applications are screened by a departmental committee, and the best qualified applicants will be accepted until all available spaces are filled.

**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. New students supported by departmental research/teaching assistantships may elect to 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 cooperative research in more than one laboratory. 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 Biology of Plant Pathogens  
PB 503 Systematic Botany  
PB 544 Plant Geography  
PB 545 Paleobotany  
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 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

# Plant Pathology

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Plant Pathology</a>	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](mailto: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, S. A. Lommel, G. A. Payne

*William Neal Reynolds Professor and Head of Botany Department:* M. E. Daub

*William Neal Reynolds Professor of Plant Pathology:* E. L. Davis

*Professors:* D. M. Benson, D. M. Bird, R. I. Bruck, L. F. Grand, S. Leath, J. W. Moyer, C. H. Opperman, J. B. Ristaino, D. F. Ritchie, R. C. Rufty, H. D. Shew, T. B. Sutton; *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, C. G. Van Dyke, J. C. Wells, N. N. Winstead; *Associate Professors:* M. Cubeta, G. J. Holmes, S. Hu, F. J. Louws; *Associate Professors (USDA):* R. G. Upchurch; *Adjunct Associate Professors:* Y. Lee; *Assistant Professors:* I. Carbone, K. L. Ivors, A. Mila, P. Ojiambo, 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:* W. M. Hagler, Jr., C. L. Hemenway; *Professors Emeriti:* E. B. Cowling

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, bioinformatics, 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 Biology of Plant Pathogens  
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(MB) 715 Applied Evolutionary Analysis of Population Genetic Data  
PP 725 Molecular Biology of Plant Viruses  
PP 727 Ecology of Soil Ecosystems  
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
<a href="#">Poultry Science</a>			Y		Y		

## GRADUATE FACULTY

S. L. Pardue, *Department Head*

### *Director of Graduate Programs:*

J. T. Brake, Box 7608, 515.5060, [jbrake@ncsu.edu](mailto: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, W. J. Croom Jr., F. W. Edens, P. R. Ferket, J. L. Grimes, W. M. Hagler Jr., J. F. Ort, S. L. Pardue, C. R. Parkhurst, J. N. Petitte, 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, V. L. Christensen, W. E. Donaldson, J. D. Garlich, E. W. Glazener, P. B. Hamilton, J. R. Harris, G. B. Havenstein, C. H. Hill, B. W. Sheldon; **Associate Professors:** D. K. Carver, P. E. Mozdziak, P. D. Siciliano; **Adjunct Associate Professors:** C. E. Whitfill; **Assistant Professors:** C. M. Ashwell, J. B. Hoffman, M. Koci, C. Maltecca, 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 Current Concepts in 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
<a href="#">Psychology</a>	Y		Y				

## GRADUATE FACULTY

D. Gillan, *Department Head*

### Director of Graduate Programs:

D. H. Mershon, Box 7650, 515.1724, [psych@ncsu.edu](mailto: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, 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, T. E. LeVere, J. E. R. Luginbuhl, H. G. Miller, S. E. Newman, P. W. Thayer; **Associate Professors:** C. C. Brookins, M. E. Haskett, 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, K. W. Klein; **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, human factors and ergonomics, 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 concentration. 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(ISE) 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(ISE) 740 Engineering Psychology of Human-Computer Interaction  
 PSY(ISE) 743 Ergonomic Performance Assessment  
 PSY(ISE) 744 Human Information Processing  
 PSY(ISE) 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(ISE) 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
<a href="#">Public Administration</a>	Y				Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

J. D. Coggburn, Box 8102, 515.1888, [jcoggburn@ncsu.edu](mailto:jcoggburn@ncsu.edu), Public Administration

**Professors:** C. K. Coe, D. M. Daley, G. D. Garson, R. C. Kearney; **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; **Visiting Assistant Professors:** 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 graduate certificates in non-profit management and public policy, both of 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 admitted only 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 political science courses, including at least one American government course, 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(COM) 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 553 Disaster, Crisis and Emergency Management and 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 771 Seminar on Nonprofit Organizations  
 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

## Social Work

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Social Work</a>					Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

T. U. Hancock, Box 7639, 513.7958, [tuhancoc@chass.ncsu.edu](mailto: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, J. Hall, 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
<a href="#">Sociology</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

T. N. Greenstein, Box 8107, 515.9006, [ted\\_greenstein@ncsu.edu](mailto:ted_greenstein@ncsu.edu), Sociology

*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, M. L. Schwalbe, 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, S. M. De Coster, R. L. Engen, N. Haenn, S. C. Lilley, A. H. Ross, W. R. Smith, M. Thomas, M. S. Thompson, R. J. Thomson, J. M. Wallace III, W. Wormsley; *Adjunct Associate Professors:* J. F. Thigpen, C. R. Zimmer; *Associate Professors Emeriti:* R. C. Brisson, R. F. Czaja, A. C. Davis, M. L. Walek; *Assistant Professors:* S. K. Bowen, D. T. Case, B. Clark, M. Crowley, S. Elliott, R. S. Ellovich, S. M. Fitzpatrick, J. K. Jacka, A. Jorgenson, S. McDonald

### 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 1 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

## Soil Science

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Soil Science</a>	Y		Y		Y		

### GRADUATE FACULTY

M. G. Wagger, *Department Head*

#### *Director of Graduate Programs:*

T. J. Smyth, Box 7619, 515.2838, [tj\\_smyth@ncsu.edu](mailto:tj_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, C. R. Crozier, 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, D. L. Lindbo, R. A. McLaughlin, W. Shi, J. G. White; **Associate Professors Emeriti:** J. P. Lilly, G. C. Naderman Jr.; **Assistant Professors:** O. W. Duckworth, R. J. Gehl, A. K. Graves, J. M. Grossman, J. L. Heitman; **Adjunct Assistant Professors:** D. H. Hardy, R. O. Maguire, J. T. Walker

### ASSOCIATE MEMBERS OF THE PROGRAM

**Professors:** R. W. Skaggs

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; soil mineralogy.

**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

## Specialized Veterinary Medicine

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Specialized Veterinary Medicine</a>					Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

D. C. Dorman, Box 8401, 513.6213, [david\\_dorman@ncsu.edu](mailto:david_dorman@ncsu.edu), Specialized Veterinary Medicine

#### *Burroughs Wellcome Distinguished Professor:* J. E. Riviere

**Professors:** G. W. Almond, K. L. Anderson, P. Arasu, 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, D. C. Dorman, M. J. Dykstra, L. N. Fleisher, O. J. Fletcher Jr., R. B. Ford, F. J. Fuller, J. E. Gadsby, 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. Tsatis, 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:** 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, B. Gilger, E. M. Hardie, C. A. Harms, J. M. Horowitz, L. C. Hudson, S. L. Jones, B. W. Keene, J. M. Law, G. A. Lewbart, M. B. McCaw, S. A. C. Nelson, 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, T. E. Eling, M. R. Loomis, J. A. Raleigh, 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, P. R. Hess, B. D. Lascelles, K. E. Linder, D. J. Marcellin-Little, K. G. Mathews, K. R. Munana, L. E. Williams; **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

## Statistics

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Statistics</a>	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](mailto: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, S. K. Ghosh, 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. 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, 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, B. Reich, E. A. Stone, W. Sun, J. Tzeng, H. (. Wang, K. S. Weems, Y. Wu, 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 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. Students may apply to either the Master's or PhD program directly from a Bachelor's degree. GRE General Test scores are required, but Subject Test scores are not.

The written statement should not exceed two pages and should describe the applicant's academic and career goals as well as special interests in the area of statistics. Individuals applying for fall enrollment and who wish to be considered for financial aid should have their completed applications in by no later than December 15 of the preceding year. Applications arriving after that will be considered but may be assigned lower priority. Students are not normally admitted for spring or summer enrollment.

**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 15 are Ph.D. core courses (ST/MA 778, 779, ST 793, ST 794, and a computing course), one is supervised consulting (ST 841), and six are Ph.D.-level statistics electives. Requirements for co-majors are individually tailored.

**Student Financial Support:** Departmental assistantships and fellowships are awarded each year on a competitive basis. Approximately 40 teaching assistantships and 30 research assistantships and traineeships are available along with several graduate industrial traineeships supported by local industries.

**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.

## 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 Epidemiology  
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 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(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

## Teaching (College of Education Dean's Office)

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Teaching</a>				Y			

## GRADUATE FACULTY

### *Director of Graduate Programs:*

G. Holley, Box 7801, 513.0083, [grant\\_holley@ncsu.edu](mailto:grant_holley@ncsu.edu), Teaching

**Professors:** E. McIntyre, R. J. Pritchard, E. J. Sabornie; **Associate Professors:** V. W. DeLuca, H. S. Lee, J. K. Lee, S. S. Osborne; **Assistant Professors:** L. Annetta, M. Blanchard

The Master of Arts in Teaching (MAT) program is an accelerated teacher licensure program that leads its students to both an initial teaching license and a Master's degree in just a year and a half of full-time study. The program is distinct in that it as a focus on practice and is held in a public school facility. The content areas being served by the MAT are secondary Math, Science, Social Studies, and English; Middle Grades (Language Arts or Social Studies); Technology Education, Special Education and Elementary Education.

**Admission Requirements:** Applicants must have (1) a four-year degree from a college or university that holds regional accreditation, such as SACS; (2) a combined score of 1000 on the GRE (500 verbal and 500 quantitative); (3) 3.00 GPA or higher in prior work, as required by the Graduate School; (4) 24 Semester hours/credits in content relevant to the area in which you wish to teach (if you have fewer than 24 hours in a relevant content field, of if your course work does not prepare you adequately to teach the North Carolina curriculum, you may be assigned course work to overcome the deficiency).

Applications require original transcripts, 3 letters of recommendation, one of which should speak to teaching potential, a personal essay stating applicant's background and goals, GRE scores (and TOEFL if you have international citizenship), and a completed online application.

**Master's Degree Requirements:** Depending on the content area, the degree requirements will range from 39-42 hours. These hours include student teaching for non-lateral entry student.

**Student Financial Support:** Financial aid is available. Interested students should complete a [Financial Aid Federal Student Aid \(FAFSA\)](#) form.

## GRADUATE COURSES

ECI 579 Organization and Behavioral Management of Diverse Classrooms

ED 507 Principles of Developing and Interpreting Assessment

ED 508 Exploring Diversity in Classroom and Community

ED 569 Teaching Internship: MAT

ED 570 Classroom Action Research

ED 571 Inquiry and Professional Development

ED 572 Teacher Leadership

ED 601 Seminar in Professional Growth and Inquiry

EDP 582 Adolescent Psychology

## Textile Engineering, Chemistry and Science

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Textile Chemistry</a>			Y				
<a href="#">Textile Engineering</a>			Y				



## GRADUATE FACULTY

B. S. Gupta, *Interim Department Head*

### *Director of Graduate Programs:*

P. J. Hauser, Box 8301, 513.1899, [peter\\_hauser@ncsu.edu](mailto: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. Pourdeyehimi

*Professors:* K. R. Beck, T. G. Clapp, T. K. Ghosh, B. S. Gupta, H. Hamouda, P. J. Hauser, S. M. Hudson, W. J. Jasper, M. W. King, 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, G. N. Mock, M. H. M. Mohamed, C. B. Smith, M. H. Theil, C. Tomasino, P. A. Tucker Jr.; *Associate Professors:* P. Banks-Lee, D. Hinks, G. L. Hodge, J. A. Joines, R. E. Kotek, M. G. McCord, S. Michielsen, R. Shamey; *Adjunct Associate Professors:* T. G. Montgomery; *Assistant Professors:* A. M. El-Shafei, R. E. Gorga, W. E. Krause, M. Pasquinelli, X. Zhang; *Adjunct Assistant Professors:* H. Boyter Jr., R. A. Moore, H. S. Whang

## ASSOCIATE MEMBERS OF THE PROGRAM

*Professors:* W. Oxenham, R. E. Fornes, R. J. Spontak, M. W. Suh; *Professors Emeriti:* R. A. Barnhardt, R. A. Donaldson, H. G. Olf

**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 33 credit hours is required for MS/TC and 30 credit hours for MS/TE.

**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(CHE) 769 Polymers, Surfactants and Colloidal Materials  
TC 771 Polymer Microstructures, Conformations and 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

# Textile Technology Management

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Textile Technology Management</a>	Y						

## GRADUATE FACULTY

### Director of Graduate Programs:

W. Oxenham, Box 8301, 515.6573, [william\\_oxenham@ncsu.edu](mailto: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 Professor and Distinguished University Professor:** 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, T. K. Ghosh, B. S. Gupta, H. Hamouda, P. J. Hauser, 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, R. A. Donaldson, A. H. M. El-Shiekh, P. L. Grady, S. P. Hersh, D. M. Holthausen Jr., 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, M. R. Jones, R. E. Kotek, T. M. Lamar, J. K. McCreery, S. Michielsen, N. B. Powell, R. Shamey, G. W. Smith; **Assistant Professors:** R. E. Gorga, W. E. Krause; **Visiting Assistant Professors:** R. Liu, 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 582 Global Textile Brand Management and Marketing  
TTM 583 Strategic Planning for Textile Firms  
TTM(MBA) 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

## Textile and Apparel Management

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Textiles</a>			Y		Y		

### GRADUATE FACULTY

N. L. Cassill, *Department Head*

#### *Director of Graduate Programs:*

A. M. Seyam, Box 8301, 515.6583, [a\\_seyam@ncsu.edu](mailto:a_seyam@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, T. G. Clapp, 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, R. A. Donaldson, A. H. M. El-Shiekh, M. H. M. Mohamed, W. C. Stuckey Jr.; **Associate Professors:** P. Banks-Lee, K. T. Barletta, K. Carroll, H. H. A. Hergeth, G. L. Hodge, C. L. Istook, M. R. Jones, T. M. Lamar, S. Michielsen, M. Moore, N. B. Powell, G. W. Smith; **Adjunct Associate Professors:** M. A. Messura, E. D. Parrish, D. Shiffler; **Associate Professors Emeriti:** H. A. Davis, P. B. Hudson, M. L. Robinson Jr.; **Assistant Professors:** H. J. Lee; **Visiting Assistant Professors:** R. Liu, E. Shim, H. Vahedi Tafreshi

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.

**Master of Science:** The objective of the Master of Science (MS) 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 conduct research 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.

**Master of Textiles:** 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.

**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 houses a Digital Design lab which specializes in 3D Body Scanning, Direct Digital Printing, Whole Body Knitted Garments, and Computer Aided Apparel and Fabric Design. Additionally, the department includes the Sara Lee Knit Products Apparel Lab, a Braiding Lab, a Three-Dimensional Weaving Lab, and an Advanced Testing Lab that allows students to experience hands-on advanced textile technology and management.

## 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 582 Global Textile Brand Management and Marketing  
 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

## Toxicology

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Toxicology</a>	Y		Y		Y		

### GRADUATE FACULTY

#### *Director of Graduate Programs:*

R. C. Smart, Box 7633, 515.7245, [robert\\_smart@ncsu.edu](mailto:robert_smart@ncsu.edu), Toxicology

*Distinguished Professor Emeritus:* E. Hodgson

**Professors:** G. A. LeBlanc, D. Shea, R. C. Smart; **Adjunct Professors:** J. A. Bond, N. Chernoff, H. Cunny, J. E. Gibson, J. A. Goldstein, L. E. Gray, W. F. Greenlee, R. J. Langenbach, R. O. McClellan, R. J. Preston, A. J. Tobia, D. C. Zeldin; **Professors Emeriti:** R. B. Leidy, T. J. Sheets; **Associate Professors:** J. C. Bonner, W. G. Cope, J. Tsuji, Y. Tsuji; **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, 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, E. Guthrie-Nichols, H. M. Hassan, S. M. Laster, N. A. Monteiro-Riviere, P. L. Sannes, M. K. Stoskopf; **Research Professors:** A. R. Brody; **Associate Professors:** R. E. Baynes, J. M. Horowitz, M. Hyman, J. M. Law; **Assistant Professors:** H. B. Patisaul, 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. Examples of types of environmental agents that are being investigated include environmental carcinogens, pesticides, particulates metals, endocrine disruptors, nanoparticles and radiation.

**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 applicants 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 students 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 515 Environmental Toxicology and Chemistry  
TOX 601 Seminar  
TOX 620 Special Problems in Toxicology  
TOX 628 Principles of Reproductive and Developmental Toxicology Research  
TOX(BCH) 660 Free Radicals in Toxicology  
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  
BIT 510 Core Technologies in Molecular and Cellular Biology  
BIT 567 PCR and DNA Fingerprinting  
BIT 568 Genome Mapping  
BIT 569 RNA Purification and Analysis  
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 585 Advanced Wildlife Habitat Management  
FW 707 Environmental Stress Physiology  
GN 701 Molecular Genetics  
HS 707 Environmental Stress Physiology  
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 509 Ecology of Stream Invertebrates  
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 students advisory committee can also be included toward the 6 credit hour elective requirement. Course descriptions can be found at the [Registration and Records website](#).

# Veterinary Public Health

## Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Veterinary Public Health</a>					Y		

## GRADUATE FACULTY

### *Director of Graduate Programs:*

J. F. Levine, Box 8401, 513.6397, [jay\\_levine@ncsu.edu](mailto:jay_levine@ncsu.edu), Veterinary Public Health

*Burroughs Wellcome Distinguished Professor:* J. E. Riviere

*Professors:* G. W. Almond, K. L. Anderson, P. Arasu, 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. Tsatis, D. P. Wages; *Research Professors:* S. Kennedy-Stoskopf; *Associate Professors:* R. E. Baynes, D. K. Carver, M. T. Correa, P. Cowen, P. W. Farin, C. A. Harms, J. M. Law, M. B. McCaw, W. J. Showers, B. D. Slenning, D. W. Watson; *Assistant Professors:* M. Martin, S. Thakur

## ASSOCIATE MEMBERS OF THE PROGRAM

*Professors:* H. A. Devine; *Professors (USDA):* D. S. Marshall; *Associate Professors:* S. A. C. Nelson

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. The program's base of activity is focused at the NCSU College of Veterinary Medicine, however, enrolled students benefit from enrollment in classes at UNC-Chapel Hill and the wealth of additional public health expertise in the Research Triangle.

**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 exceptions for students with prior public health experience (contact the program directory before applying). 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 graduate record examination scores are required for graduates of U.S. accredited colleges of veterinary medicine; graduate record examination scores are required for applicants who are from non-U.S. accredited colleges of veterinary medicine. International applicants 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 48 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 mentors.

**Other relevant information:** Students can enroll full time or part time.

## 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](#). Numerous online elective course options complement classroom instruction. Each student is assigned two faculty mentors who assist with course selection and career planning.

### **CORE VETERINARY PUBLIC HEALTH PROGRAM CLASSES**

VPH 554 Trade and Agricultural Health  
VPH 650 Population Medicine Forum  
VPH 693 Supervised Public Health Research  
VPH 713 Zoonoses and Public Health  
VPH 760 Molecular Technologies for Epidemiologic Investigation

### **ADDITIONAL CORE CLASSES**

CBS 580 Clinical Veterinary Epidemiology  
CBS 581 Clinical Veterinary Epidemiology Laboratory  
CBS 784 Principles of Analytic Epidemiology  
EPI 710 Fundamentals of Epidemiology  
FS 520 Pre-Harvest Food Safety  
FS 540 Food Safety and Public Health  
PRT 562 Principles of Geographic Information Systems  
ST 505 Applied Nonparametric Biostatistics  
ST 511 Experimental Statistics for Biological Sciences  
ST 512 Experimental Statistics for Biological Sciences II

### **ELECTIVE EPIDEMIOLOGY CLASSES (UNC)**

EPI 715 Theory and Quantitative Methods In Epidemiology  
EPI 718 Epidemiologic Analysis of Binary Data  
EPI 722 Epidemiologic Analysis of Time-to-Event Data  
EPI 733 Clinical Trials in Epidemiology  
EPI 735 Cardiovascular Disease Epidemiology  
EPI 743 Genetic Epidemiology: Methods and Applications  
EPI 745 Molecular Techniques for Public Health Research  
EPI 751 Emerging and Re-Emerging Infectious Diseases  
EPI 752 Introduction to Methods in Infectious Disease Epidemiology  
EPI 753 Prevention and Control of Infectious Diseases at the Community Level  
EPI 754 Mathematical Modeling of Infectious Diseases  
EPI 756 Control of Infectious Diseases on Developing Countries  
EPI 757 Epidemiology of HIV/Aids in Developing Countries  
EPI 758 Methods and Principles of Applied Infectious Disease Epidemiology  
EPI 759 Methods in Field Epidemiology  
EPI 780 Occupational Injury and Violence as a Public Health Problem  
EPI 785 Environmental Epidemiology  
EPI 786 Community-Driven Epidemiology and Environmental Justice

### **COMMUNITY PREPAREDNESS AND DISASTER MANAGEMENT (UNC ONLINE)**

HPAA 420 Community and Public Health Security  
HPAA 421 Community and Public Health  
HPAA 422 Analytic Methods  
HPAA 423 Disaster Management Issues

### **ELECTIVE STATISTICS AND GIS CLASSES**

BMA 722 Decision Analytic Modeling  
BMA 773 Stochastic Modeling  
BMA 567 Modeling of Biological Systems

FOR 554 Principles of Spatial Analysis  
 PRT 555 Environmental Impacts of Recreation and Tourism  
 PRT 563 Technical Issues In Geographic Information Systems  
 PRT 764 Advanced Study In Geographic Information Systems  
 ST 506 Sampling Animal Populations  
 ST 535 Statistical Process Control  
 ST 546 Probability and Stochastic Processes I  
 ST 552 Linear Models and Variance Components  
 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

#### ADDITIONAL ELECTIVE CLASSES

BUS 541 Strategic Information Technology  
 FS 530 Post-Harvest Food Safety  
 FS 553 Food Laws and Regulations  
 FS 722 Microbial Food Safety  
 MIS 601 Colloquium in International Development  
 SOC 758 Rural Sociology  
 SOC 762 Urban Ecology  
 TOX 704 Chemical Risk Assessment  
 VPH 555 Public Health, Sustainable Development and Gender in Global Context  
 VPS(FW) 720 Epidemiology of Wildlife Diseases  
 ZO 582 Medical and Veterinary Entomology

## Wood and Paper Science

#### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Wood and Paper Science</a>	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](mailto:richard_venditti@ncsu.edu), Wood & Paper Science

*Elis and Signe Olsson Professor of Wood and Paper Science:* H. Jameel

*Jordan Family Distinguished Professor for Natural Resources Innovation Professor:* V. L. Chiang

*Reuben B. Robertson Professor:* H. Chang

**Professors:** D. Argyropoulos, 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, 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:** P. W. Hart; **Assistant Professors:** M. V. Byrd, S. Dasmohapatra

## ASSOCIATE MEMBERS OF THE PROGRAM

**Professors:** S. A. Khan; **Professors Emeriti:** E. B. Cowling

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. A qualifying exam 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 of students who have relevant professional experience, including one hour of Seminar (WPS 591) and an independent project (WPS 625). For distance students without relevant professional experience, 36 hours is required.

**Doctoral Degree Requirements:** In addition to Graduate School requirements, Ph.D. candidates must present two departmental seminars (WPS 791) before their final oral examination which will be arranged. Candidates must also write and defend a research proposal on their intended research (first proposition) and a research proposal on an area outside of their dissertation/thesis research (termed a second proposition) and pass qualifying exams.

**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 required to take the qualifying examination(s) after one semester of residence. These examinations are to ensure that the student has the basic abilities to think independently as a scientist within the context of the forest biomaterials literature. The department believes M.S. and Ph.D. students should select a research topic and begin their dissertation or 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

## Zoology

### Degrees Offered:

Program Title	Ph.D.	Ed.D.	M.S.	M.A.	Master of	M.Ed.	MFA
<a href="#">Zoology</a>	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](mailto:harry_daniels@ncsu.edu), Zoology

**William Neal Reynolds Professor:** R. R. H. Anholt

**Professors:** B. L. Black, R. J. Borski, H. V. Daniels, 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; **Professors Emeriti:** G. T. Barthalmus, P. T. Bromley, B. J. Copeland, G. C. Miller, R. L. Noble, T. L. Quay, J. F. Roberts, D. E. Smith, J. G. Vandenbergh; **Associate Professors:** J. A. Buckel, 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, J. L. Campbell, R. R. Dunn, M. D. Engell, M. G. Ferzli, A. P. Flick, B. J. Grubb, M. B. Hawkins, J. L. Lubischer, L. D. Parks, 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, R. W. Laney, K. W. Shertzer, W. C. Starnes

**ASSOCIATE MEMBERS OF THE PROGRAM**

**Professors:** D. B. Eggleston, E. J. Jones, R. A. Lancia, T. M. Losordo, T. G. Wolcott; **Professors Emeriti:** P. D. Doerr; **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/](http://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

## 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](mailto:biotech@ncsu.edu)

Dr. Sue Carson, Academic Coordinator  
919.513.0330  
Email: [sue\\_carson@ncsu.edu](mailto: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 501 Ethical Issues in Biotechnology  
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 570 Advanced Animal Cell Culture: Bioreactor Culture  
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](mailto: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, , E. F. Gehringer, C. Kleinstreuer, C. R. Ji, 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, 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](mailto: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 from 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 from 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  
[khorr@ncsu.edu](mailto:khorr@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

## Geographic Information Systems (Certificate Program/Minor Program)

Dr. Hugh A. Devine, Coordinator  
NCSU Box 7106  
Phone: (919) 515-3682  
Email: [hugh\\_devine@ncsu.edu](mailto: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. Mitsova; **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.

**GIS Graduate Certificate Program.** The certificate program consists of a minimum of 15 credit hours. Students entering

the program will be expected to have a working knowledge of GIS software. The certificate program is open to both degree seeking and non-degree seeking students at the graduate level.

**Prerequisite:** An introductory course in GIS (e.g. PRT 462, PA 541 or equivalent) or demonstrated ability to use GIS software.

**Core (7 credits):**

NR 532 (3) Principles of Geographic Information Science  
NR 533 (3) Application Issues in Geographic Information Systems  
FOR 510 (1) Introduction to GPS

**Electives (8 credits):**

BUS 545 (3) Management Support Systems  
CE 538 (3) Information Technology and Modeling  
ECE 759 (3) Pattern Recognition  
ECE 763 (3) Computer Vision  
ECE 764 (3) Digital Image Processing  
FOR 554 (3) Principles of Spatial Analysis  
FOR 753 (3) Environmental Remote Sensing  
LAR 500 (6) Landscape Design Studio  
LAR 512 (3) Landscape Resource Management  
NR 535 (2) Computer Cartography  
NR 536 (3) Introduction to Visual Basic for GIS  
PA 541 (3) Geographic Information Systems for Public Administration  
SSC 535 (3) Precision Agriculture and Technology  
SSC 545 (3) Remote Sensing Applications in Soil Science and Agriculture  
ST 733 (3) Spatial Statistics

**Other Requirements:**

- Admission to the certificate program requires a grade of B or better *in NR532 and NR533*. After completing these required courses, contact Linda Babcock (515-3430 or [L.Babcock@ncsu.edu](mailto:L.Babcock@ncsu.edu)) to request admission to the certificate program. You will need to provide a copy of your NCSU transcript.
- Award of a certificate requires a grade of B or better in all of the certificate courses. The GISc Faculty Coordinator will be responsible for certifying the GPA of certificate candidates.

**GIS Graduate Minor Program.** The minor program consists of a minimum of 10 credit hours. Students entering the program will be expected to have a working knowledge of GIS software.

**Prerequisite:** An introductory course in GIS (e.g. PRT 462 or equivalent) or demonstrated ability to use GIS software.

**Course Requirements (10 credits):**

NR 532 (3) Principles of Geographic Information Science  
NR 533 (3) Application Issues in Geographic Information Systems  
FOR510 (1) Introduction to GPS  
Electives (3) - see list of electives for Certificate Program

**Other Requirements:** GISc Faculty as a member of the student's graduate committee. If no graduate committee is required by the student's program, the student must obtain approval of his or her minor program from the GISc Faculty Coordinator.

## **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](mailto: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 (Minor Program)

### 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](mailto: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. Genreux (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 Environmental 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 Restoration  
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. M. Pierce, Director

**Professors:** N. S. Allen, V. J. Gallagher, 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, 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, C. A. Warren, S. T. Warren, M. Wyer; **Assistant Professors:** K. Albada, A. Bolonyai, R. S. Ellovich, K. A. Harwood, D. A. Hooker, B. Kelley, J. L. Lubischer, M. G. Orgeron

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

## 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](mailto: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. Pooneh Lari  
Assistant Professor  
Department of Adult and Higher Education  
Email: [pooneh\\_lari@ncsu.edu](mailto:pooneh_lari@ncsu.edu)  
Phone: 919.515.6290

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	TheAdult 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](mailto: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.

## Graduate Certificate in E-Learning (Certificate)

### Adult Education

Pooneh Lari, Teaching Assistant Professor  
Department of Adult and Higher Education  
NC State University  
Campus Box 7801  
Raleigh, NC 27695-7801  
Phone: 919.515.6290  
Fax: 919.515.6200  
Email: [pooneh\\_lari@ncsu.edu](mailto:pooneh_lari@ncsu.edu)

### K-12 Education

Kevin Oliver, Assistant Professor  
Department of Curriculum and Instruction  
NC State University  
Campus Box 7801  
Raleigh, NC 27695-7801  
Phone: 919.515.6229  
Fax: 919.513.1687  
Email: [kevin\\_oliver@ncsu.edu](mailto:kevin_oliver@ncsu.edu)

The Graduate Certificate in E-Learning (online) represents a response to increased interest toward e-learning design and teaching competencies in K-12, post secondary, government and corporate sectors. The program is designed to prepare graduates with the knowledge and skills necessary to assume roles in integrating e-learning into the curriculum or teaching entirely online. All certificate courses are offered online and students are required to select a focus area of either K-12 or adult education.

**Admissions:** Applicants must meet at least one of the following criteria: (1) graduate of an accredited four year college and have a GPA of at least 3.0 on a four-point scale in their last 60 credit hours of undergraduate study; (2) degree student in good standing in an NC State graduate program; or (3) have a Master's degree.

**Requirements:** The Graduate Certificate in E-Learning requires a minimum of 15 hours, including 12 hours of core courses and 3 hours of electives. Students must maintain a minimum overall GPA of B (3.0).

**Other Information:** The program is offered jointly by the Department of Adult and Higher Education and the Department of Curriculum and Instruction.

For more information, see <http://ced.ncsu.edu/ahe/elearning/>

## Horticultural Science (Certificate)

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](mailto: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 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

### 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.

## **Medical Devices (Certificate)**

Dr. Troy Nagle, Coordinator  
Department of Biomedical Engineering  
NCSU Box 7115  
Phone: 919.515.3578  
Email: [nagle@ncsu.edu](mailto:nagle@ncsu.edu)

The Graduate Certificate in Medical Devices is a joint program that links NC State's College of Engineering with the University of North Carolina School of Medicine. The program prepares graduates to conceive and design prototypes for new medical devices, write patent applications, as well as training in market assessment, financing options, etc.

**Admissions:** Students apply online through a website hosted by the Joint UNC-NCSU Department of Biomedical Engineering. The Program Committee evaluates applications using the graduate admissions criteria of the department.

**Requirements:** The program requires a total of 12 credit hours from an approved course list, including two BME advanced medical devices courses (BMS 551 and 552) and two entrepreneurial-oriented business courses.

For more information, see [www.bme.ncsu.edu](http://www.bme.ncsu.edu)

## **Molecular Biotechnology (Certificate)**

Dr. Susan Carson, Coordinator  
NCSU Box 7512  
Phone: 919.513.0330  
Email: [sue\\_carson@ncsu.edu](mailto: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 501 Ethical 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)**

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](mailto: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 (Certificate)**

Dr. Pamela Banks-Lee  
College of Textiles  
NCSU Box 8301



Phone: 919.515.6581  
Email: [pbanks-l@tx.ncsu.edu](mailto:pbanks-l@tx.ncsu.edu)

The certificate program in Nonwovens Science and Technology 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)**

Dr. Karen DeBord  
Department of Family and Consumer Sciences  
NCSU Box 7605  
Phone: 515.9147  
Email: [karen\\_debord@ncsu.edu](mailto:karen_debord@ncsu.edu)  
Website: [www.ces.ncsu.edu/depts/4hfcs/academics/cert/](http://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)

## **Public Policy (Certificate)**

Dr. Thomas Birkland, Coordinator  
Department of Public Administration  
NCSU Box 8102

Phone: 919.513.7799  
Email: [tom\\_birkland@ncsu.edu](mailto:tom_birkland@ncsu.edu)

Public policy -- the actions of government and its partners in the non-profit and private sectors -- is the keystone of politics and public administration. The creation, adoption, and implementation of public policy is a complex process. It requires skills in analysis, reasoning, and argumentation -- what we call evidence-based policy advocacy. The Graduate Certificate in Public Policy helps you make the most of your skills by providing you with the tools you need to be an effective advocate for realistic, effective, and responsible public policy.

**Admissions:** Students not attending NC State are required to submit transcripts. Current NC State students need not present transcripts, but they must be in good standing. A minimum GPA of 3.0 is required for admission to the program. Provisional admission may be granted for applicants whose GPA is below 3.0. Contact the program director for details.

**Curriculum:** The certificate requires a total of 12 credit hours consisting of Applied Political Economy (PA 509), Public Policy Analysis (PA 511), Public Policy Process (PA 598), and an elective policy or managerial course approved by the program coordinator. Electives may be from virtually any program at NC State, such as history, social sciences, natural resources, agriculture, health, business, or engineering.

**Other Information:** Students who do not have course work in social science statistics will be required to take a statistics course either at the School of Public and International Affairs or a department of the student's choosing, with approval of the program coordinator.

For more information, see [www4.ncsu.edu/~tabirkla/documents/ppcert.pdf](http://www4.ncsu.edu/~tabirkla/documents/ppcert.pdf)

## Training and Development (Certificate)

Dr. Timothy Hatcher  
Associate Professor and Coordinator  
Department of Adult and Higher Education  
Phone: 919.515.6246  
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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.

## **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)  
<http://sa.ncsu.edu/fl>

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. The following courses can be audited or taken as credit-only; 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

Certification may be obtained in languages not normally taught by the department by contacting [Dr. Dudley Marchi](#). Complete information on graduate student language certification can be found at <http://sa.ncsu.edu/fl/gradcert.htm>.

## **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 501 Kant's Critique of Pure Reason

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

- Abbate, Angelo Rudy, M.L.A., Professor Emeriti, Landscape Architecture
- Abdel-Khalik, Hany S., PhD, Visiting Assistant Professor, Nuclear Engineering
- Abdel-Rahman, Nabil, PhD, Adjunct Associate Professor, Civil 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, Nina Stromgren, Ph.D., Professor Emeritus, 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, Associate 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., Emeritus Professor of Animal Science, 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
- Amendum, Steve, PhD, Assistant Professor, Elementary Education
- Amerson, Henry Van, Ph.D., Associate Professor Emeritus of Botany and Forestry, Forestry
- Ames, Natalie, EDD, Assistant Professor, Social Work
- Amezquita, Alejandro, PhD, Adjunct Assistant Professor, Food Science
- Amoozegar, Aziz, Ph.D., Professor, Soil Science
- Anderson, Dorothy H, PhD, Professor, Parks, Recreation and Tourism Management
- 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., William Neal Reynolds Professor, Zoology
  - Anistratov, Dmitriy Y., Ph.D., Associate Professor, Nuclear Engineering
  - Annetta, Len, PhD, Assistant Professor, Mathematics, Science, & Technology Education
  - Anson, Christopher Martin, Ph.D., Professor, English
  - Anton, Ana I., Ph.D., 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., 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., 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, Associate 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
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  - 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
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- Ball, David Stafford, Ph.D., Associate Professor, Economics
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- 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., Distinguished University Professor and Drexel Professor, Mathematics
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- Baumer, David L., Ph.D., Professor, Business Management
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- Bearon, Lucille B, PhD, Associate Professor, Human Development & Family Studies
- Beasley, David Beach, Ph.D., Professor, Biological and Agricultural Engineering
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- Beck, Keith R., Ph.D., Professor, Textile Engineering, Chemistry, and Science
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- Beichner, Robert J., Ph.D., Professor, Physics
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- Birgand, Francois, PhD, Assistant Professor, Biological and Agricultural Engineering
- 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
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- Bitzer, Donald Lester, Ph.D., Distinguished University Research Professor, Computer Science
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- Blankenship, Sylvia M., Ph.D., Professor, Horticultural Science
- Blanton, Richard Lawrence, PhD, Professor, Plant Biology
- Blazich, Frank Arthur, Ph.D., Professor, Horticultural Science
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- 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
- Bobko, Christopher P, PhD, Assistant Professor, Civil Engineering
- 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
- Bogan, Arthur E., Ph.D., Adjunct Assistant Professor, Zoology
- Bogdanovich, Alexander, PhD, Adjunct Professor, Textile Engineering, Chemistry, and Science
- Bohlman, Jonathan, PhD, Associate Professor, Business Management
- Bohnenstiehl, DelWayne R., PhD, Assistant Professor, Marine, Earth, and Atmospheric Sciences
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- Bolonyai, Agnes, PhD, Assistant Professor, English
- Bond, James Anthony, Ph.D., Adjunct Professor, Toxicology
- Bondell, Howard D., PhD, Assistant Professor, Statistics
- Bonham, Julia C., Ph.D., Visiting Assistant Professor, History
- Bonner, James C., Ph.D., Associate Professor, Molecular Biomedical Sciences
- Booker, Fitzgerald L., PhD, Associate Professor (USDI/USFS), Crop Science
- Booker, Matthew Morse, PhD, Assistant Professor, History
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- Boone, Edgar John, Ph.D., Professor Emeritus of Adult and Community College Education, Adult and Higher Education
- Boone, Kofi, MR, Assistant Professor, Landscape Architecture
- Boos, Dennis Dale, Ph.D., Professor, Statistics
- Borden, Robert C., Ph.D., Professor, Civil Engineering
- Borden, Roy H., Ph.D., Professor, Civil Engineering
- Borkowski, Kazimierz Jan, Ph.D., Research Associate Professor, Physics
- Borski, Russell J., Ph.D., Professor, Zoology
- Boss, Charles Ben, Ph.D., Associate Professor Emeritus of Chemistry, Chemistry
- Boss, Wendy Farmer, Ph.D., William Neal Reynolds Distinguished Professor, Plant Biology
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- Boston, Rebecca S., Ph.D., William Neal Reynolds Professor, Plant Biology
- Bosworth, Ryan, PhD, Assistant Professor, Political Science and Public Administration
- Bottomley, Laura J., Ph.D., Adjunct Assistant Professor, Electrical and Computer Engineering
- Bourham, Mohamed A., Ph.D., Professor, Nuclear Engineering
- Bowden, Edmond Francis, Ph.D., Professor, Chemistry
- Bowen, S. K., PhD, Assistant Professor, Sociology and Anthropology
- Bowers, Crowell Gattis Jr., Ph.D., Professor Emeriti of Biological and Agricultural Engineering, Biological and Agricultural Engineering
- Bowles, Tuere A., PhD, Assistant Professor, Adult and Higher Education
- Bowman, Daniel Clark, Ph.D., Associate Professor, Crop Science
- Boyd, Leon C., Ph.D., Professor, Food Science
- Boyette, Michael Doyle, Ph.D., Professor, Biological and Agricultural Engineering
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- Boyter, Henry Jr., PhD, Adjunct Assistant Professor, Textile Engineering, Chemistry, and Science
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- Braden, Jeffery P., PhD, Professor, Psychology
- Bradford, Marianne, PhD, Associate Professor, Accounting
- Bradley, Julius Roscoe Jr., Ph.D., Professor Emeritus of Entomology, Entomology
- Bradley, Lucy K., PhD, Assistant Professor, Horticultural Science
- Brady, Kevin P., PhD, Assistant Professor, Educational Leadership and Policy Studies
- Braham, Richard R., Ph.D., Professor, Forestry
- Braham, Roscoe R., Ph.D., Scholar in Residence, Marine, Earth, and Atmospheric Sciences

- Brake, John Thomas, Ph.D., William Neal Reynolds Distinguished Professor and Director of Graduate Programs ANP and PSC, Poultry Science
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- Brandeis, Susan Dowman, M.F.A., Professor, Art and Design
- Brandenburg, Rick Lynn, Ph.D., William Neal Reynolds Professor, Entomology
- Brandt, Jon A., Ph.D., Professor, Economics
- Branoff, Theodore J., Ph.D., Associate Professor, Mathematics, Science, & Technology Education
- Branson, Bruce C., Ph.D., Professor, Accounting
- Braunbeck, Helga Gerlinde, Ph.D., Associate Professor, Foreign Languages and Literatures
- Brazel, Joseph F., PHD, Assistant Professor, Accounting
- Breen, Matthew, PhD, Associate Professor, Molecular Biomedical Sciences
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- Bressler, Gene, MLA, Professor, Landscape Architecture
- Breuhaus, Babetta Ann, Ph.D., Associate Professor, Department of Clinical Sciences
- Brewer, Holly, Ph.D., Associate Professor, History
- Brickley, James John, Ph.D., Associate Professor, Electrical and Computer Engineering
- Bridgwater, Floyd Emmitt Jr., Ph.D., Professor (USDA), Forestry
- Brill, Earl Downey Jr., Ph.D., Professor, Civil Engineering
- Brim, Charles Aloysius, Ph.D., Professor Emeritus of Crop Science, Crop Science
- Brinson, Kenneth H. Jr., Ph.D., Assistant Professor, Educational Leadership and Policy Studies
- Brisson, Robert Curtis, Ph.D., Associate Professor Emeritus of Sociology and Anthropology, Sociology and Anthropology
- Bristol, David G., D.V.M., Associate Professor, Department of Clinical Sciences
- Brody, Arnold R., Phd, Research Professor, Veterinary Medicine
- Bromley, Peter T., Ph.D., Professor Emeritus of Zoology, Zoology
- Brookins, Craig C., Ph.D., Associate Professor, Psychology
- Brooks, Wayne Maurice, Ph.D., Professor Emeritus of Entomology, Entomology
- Broome, Stephen White, Ph.D., Professor, Soil Science
- Brothers, Gene LeRoy, Ph.D., Associate Professor, Parks, Recreation and Tourism Management
- Brown, Alvin Blake, Ph.D., Hugh C. Kiger Professor, Economics
- Brown, Betsy, PhD, Adjunct Assistant Professor, Adult and Higher Education
- Brown, Christopher S., Ph.D., Professor, Plant Biology
- Brown, Dennis T., Ph.D., Professor, Biochemistry
- Brown, Henry Seawell, Ph.D., Professor Emeritus of Marine, Earth and Atmospheric Sciences, Marine, Earth, and Atmospheric Sciences
- Brown, J. David, Ph.D., Associate Professor, Physics
- Brown, James W., Ph.D., Associate Professor, Microbiology
- Brown, Marvin Luther Jr., Ph.D., Professor Emeritus of History, History
- Brown, Robert D., PhD, Professor, Forestry
- Brown, Talmage T. Jr., Ph.D., Professor, Population Health & Pathobiology
- Brown-Graham, Anita R., J.D., Professor, Landscape Architecture
- Brown-Guedira, Gina, PhD, Associate Professor (USDA), Crop Science
- Brownie, Cavell, Ph.D., Professor, Statistics
- Bruck, Robert Ian, Ph.D., Professor, Plant Pathology
- Bruneau, Arthur Henry, Ph.D., Professor, Crop Science
- Brunet, James R., PhD, Assistant Professor, Political Science and Public Administration
- Bruno-Barcena, Jose M., PhD, Research Assistant Professor, Microbiology
- Bryan, Robert Sedgwick, Ph.D., Professor Emeritus of Philosophy and Religion, Philosophy and Religion
- Bryant, Alyssa N., PhD, Assistant Professor, Adult and Higher Education
- Bryant, Charles Douglas, Ed.D., Associate Professor Emeritus, Agricultural and Extension Education
- Bryden, Wayne L., Ph.D., Adjunct Professor, Poultry Science
- Buchanan, David R., Ph.D., Professor Emeritus of Textile Engineering, Chemistry and Science, Textile Engineering, Chemistry, and Science

- Buchwalter, David, PhD, Assistant Professor, Toxicology
  - Buckel, Jeffrey A., Ph.D., Associate Professor, Zoology
  - Buckless, Frank Alan Orth, Ph.D., Professor, Accounting
  - Buckner, Gregory D., Ph.D., Associate Professor, Mechanical and Aerospace Engineering
  - Buhler, Wayne G., Ph.D., Associate Professor, Horticultural Science
  - Buie, Timothy, Master, Assistant Professor, Industrial Design
  - Bull, Leonard Seth, Ph.D., Professor, Animal Science
  - Bullock, Bronson P., PhD, Associate Professor, Forestry
  - Bumgardner, Carl Lee, Ph.D., Professor Emeritus of Chemistry, Chemistry
  - Buol, Stanley Walter, Ph.D., William Neal Reynolds Professor Emeritus, Soil Science
  - Buongiorno-Nardelli, Marco, Ph.D., Associate Professor, Physics
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- Tayebali, Akhtarhusein A., Ph.D., Associate Professor, Civil Engineering
- Taylor, Andrew J., Ph.D., Associate Professor, Political Science and Public Administration
- Taylor, Eileen Z., PhD, Assistant Professor, Accounting
- Taylor, Laura O., PhD, Professor, Economics
- Tector, John O., Ph.D., Associate Professor, Architecture
- Temple, William, MFA, Assistant Professor, Graphic Design
- Terry, Stephen, PhD, Assistant Professor, Mechanical and Aerospace Engineering
- Tesar, Paul, Ph.D., Professor, Architecture
- Thakur, Siddhartha, PhD, Assistant Professor, Population Health & Pathobiology
- Tharp, Alan Lee, Ph.D., Professor, Computer Science
- Thayer, Paul W., Ph.D., Professor of Psychology and Head of the Department, Psychology
- Theil, Elizabeth C., Ph.D., Adjunct Professor, Biochemistry
- Theil, Michael Herbert, Ph.D., Professor Emeritus of Textile Engineering, Chemistry and Science, Textile Engineering, Chemistry, and Science
- Theuer, Richard C., PhD, Adjunct Professor, Food Science
- Theyson, Thomas W., PhD, Adjunct Professor, Textile and Apparel Management
- Thies-Sprinthall, Lois, Ed.D., Associate Professor Emeritus of Curriculum and Instruction, Curriculum and Instruction
- Thigpen, John F., Ph.D., Adjunct Associate Professor, Sociology and Anthropology
- Thomas, Carrie, PhD, Visiting Assistant Professor, Marine, Earth, and Atmospheric Sciences
- Thomas, Erik R., Ph.D., Associate Professor, English
- Thomas, Judith Fey, Ph.D., Professor Emeritus of Botany and Interim Director, Phytotron, Plant Biology
- Thomas, Melvin, Ph.D., Associate Professor, Sociology and Anthropology
- Thomas, Richard Joseph, Ph.D., Professor Emeritus of Wood and Paper Science, Wood and Paper Science
- Thompson, Alton, PhD, Adjunct Professor, Sociology and Anthropology
- Thompson, Donald Loraine, Ph.D., Professor Emeritus of Crop Science, Crop Science
- Thompson, Elizabeth Alison, Adjunct Professor, Statistics
- Thompson, Jeffrey Ray, PhD, Research Assistant Professor, Statistics
- Thompson, Jon Francis, Ph.D., Professor, English
- Thompson, Lori Foster, PhD, Assistant Professor, Psychology
- Thompson, Maxine Seaborn, Ph.D., Associate Professor, Sociology and Anthropology
- Thompson, William F., Ph.D., Distinguished University Professor, Plant Biology
- Thomson, Randall J., Ph.D., Associate Professor, Sociology and Anthropology
- Thorne, Jeffrey L., Ph.D., Professor, Genetics
- Thrall, Donald E., Ph.D., Professor, Molecular Biomedical Sciences
- Thuente, David J., Ph.D., Professor, Computer Science

- Thuente, Mary Helen, PhD, Professor, English
- Thurman, Walter N., Ph.D., Professor, Economics
- Tilley, David Ronald, Ph.D., Professor Emeritus of Physics, Physics
- Tilotta, David, PhD, Associate Professor, Wood and Paper Science
- Timothy, David Harry, Ph.D., Professor Emeritus of Crop Science, Crop Science
- Ting, Siu-Man Raymond, Ph.D., Associate Professor, Curriculum and Instruction
- Tittle, Charles S, Ph.D., Glaxo Wellcome Endowed Chair, Sociology and Anthropology
- Tobia, Abraham J., PhD, Adjunct Professor, Toxicology
- Tolson, Robert H., PhD, Research Professor, Mechanical and Aerospace Engineering
- Tomas, Carmelo R, PhD, Adjunct Associate Professor, Marine, Earth, and Atmospheric Sciences
- Tomas, Stacy R, PhD, Assistant Professor, Parks, Recreation and Tourism Management
- Tomasino, Charles, Ph.D., Professor Emeritus of Textile Engineering, Chemistry and Science, Textile Engineering, Chemistry, and Science
- Tomlinson, James Davis, M.LAR., Research Associate Professor, Landscape Architecture
- Tommerdahl, Mark A., PhD, Adjunct Associate Professor, Biomedical Engineering
- Tompkins, Mary B., Ph.D., Professor, Population Health & Pathobiology
- Tompkins, Wayne A. F., Ph.D., Professor, Population Health & Pathobiology
- Tonelli, Alan Edward, Ph.D., Kosa Professor of Fiber and Polymer Chemistry, Textile Engineering, Chemistry, and Science
- Tong, Quansong, PhD, Adjunct Assistant Professor, Marine, Earth, and Atmospheric Sciences
- Tonkonogy, Susan L., Ph.D., Associate Professor, Population Health & Pathobiology
- Toole, William Bell III, Ph.D., Professor Emeritus of English, English
- Toplikar, Susan M., M.F.A., Associate Professor, Art and Design
- Tornatzky, Louis G., Ph.D., Adjunct Professor, Psychology
- Tove, Shirley R., Ph.D., Adjunct Professor, Microbiology
- Townsend, David M, PhD, Assistant Professor, Business Management
- Townsend, J. Keith, Ph.D., Professor, Electrical and Computer Engineering
- Townsend, Scott, M.F.A., Associate Professor, Graphic Design
- Tracy, Joseph B., PhD, Assistant Professor, Materials Science and Engineering
- Tran, Hien T., Ph.D., Professor, Mathematics
- Tredway, Lane, PhD, Assistant Professor, Plant Pathology
- Trew, Robert J., PhD, Alton and Mildred Lancaster Distinguished Professor, Electrical and Computer Engineering
- Triantaphyllou, Anastasios Christos, Ph.D., Professor Emeritus of Genetics, Genetics
- Triantaphyllou, Hedwig Hirschmann, Ph.D., Professor Emeritus of Plant Pathology, Plant Pathology
- Troyer, James Richard, Ph.D., Professor Emeritus of Botany, Plant Biology
- Truong, Van-Den, PhD, Associate Professor, Food Science
- Truskey, George A., Ph.D., Adjunct Associate Professor, Mechanical and Aerospace Engineering
- Trussell, Henry Joel, Ph.D., Professor, Electrical and Computer Engineering
- Tsiatis, Anastasios A., Ph.D., Professor, Statistics
- Tsoulouhas, Theofanis C., Ph.D., Associate Professor, Economics
- Tsuji, Jun, PhD, Associate Professor, Toxicology
- Tsuji, Yoshiaki, PhD, Associate Professor, Toxicology
- Tsynkov, Semyon Victor, Ph.D., Associate Professor, Mathematics
- Tu, Juei Feng, PhD, Professor, Mechanical and Aerospace Engineering
- Tuck, James M. III, PhD, Assistant Professor, Electrical and Computer Engineering
- Tucker, Paul Arthur Jr., Ph.D., Professor Emeritus of Textile Engineering, Chemistry and Science, Textile Engineering, Chemistry, and Science
- Tucker, William Preston, Ph.D., Professor Emeritus of Chemistry, Chemistry
- Tung, Chi Chao, Ph.D., Professor Emeritus of Civil Engineering, Civil Engineering
- Turinsky, Paul J., Ph.D., Professor, Nuclear Engineering
- Turner, James Edward, PhD, Assistant Professor, Animal Science
- Turner, Lynn Gilbert, Ph.D., Professor, Food Science
- Tyler, Beverly B., Ph.D., Associate Professor, Business Management
- Tyler, Richard E., PhD, Adjunct Assistant Professor, Curriculum and Instruction
- Tzeng, Jung-Ying, PhD, Assistant Professor, Statistics

- Uknes, Scott, PhD, Adjunct Assistant Professor, Genetics
  - Ullrich, David Frederick, Ph.D., Associate Professor Emeritus, Mathematics
  - Umbach, Paul, PhD, Associate Professor, Adult and Higher Education
  - Underwood, Herbert A. Jr., Ph.D., Professor, Zoology
  - Uni, Zehava, PhD, Adjunct Professor, Poultry Science
  - Unrath, Claude Richard, Ph.D., Professor Emeritus of Horticultural Science, Horticultural Science
  - Upchurch, Robert Gregory, Ph.D., Associate Professor (USDA), Plant Pathology
  - Uzsoy, Reha, PhD, Clifton A. Anderson Distinguished Professor, Industrial Engineering
- 
- Vaden, Shelly L., Ph.D., Associate Professor, Department of Clinical Sciences
  - Vahedi Tafreshi, Hooman, PhD, Visiting Assistant Professor, Textile and Apparel Management
  - van der Vaart, Donald Robert, Ph.D., Adjunct Associate Professor, Civil Engineering
  - van der Veer, Hendrick Willem, Ph.D., Adjunct Associate Professor, Zoology
  - Van Der Wiele, Cynthia F., PhD, Adjunct Assistant Professor, Landscape Architecture
  - Van Duyn, John Wey, Ph.D., Philip Morris Professor, Entomology
  - Van Dyke, Cecil Gerald, Ph.D., Professor Emeritus of Botany and Plant Pathology, Plant Biology
  - van Heugten, Eric, Ph.D., Associate Professor, Animal Science
  - van Kempen, Theo A., Ph.D., Adjunct Professor, Animal Science
  - van Zanten, John H., Ph.D., Visiting Assistant Professor, Chemical Engineering
  - Van Zyl, Leonel, PhD, Adjunct Assistant Professor, Forestry
  - Vandenbergh, John Garry, Ph.D., Professor Emeritus of Zoology, Zoology
  - Vander Wall, William John, Ed.D., Assistant Professor Emeritus, Mathematics, Science, & Technology Education
  - Vargo, Edward L., Ph.D., Associate Professor, Entomology
  - Varnado, Terri E., PhD, Assistant Professor, Mathematics, Science, & Technology Education
  - Vasu, Ellen Storey, Ph.D., Professor, Curriculum and Instruction
  - Vasu, Michael Lee, Ph.D., Associate Professor, Political Science and Public Administration
  - Vaughan, George B., Ph.D., Professor Emeritus of Adult and Community College Education, Adult and Higher Education
  - Veal, Matthew W., PhD, Assistant Professor, Biological and Agricultural Engineering
  - Velev, Orlin D., PhD, Professor, Chemical Engineering
  - Venditti, Richard A., Ph.D., Associate Professor, Wood and Paper Science
  - Vepraskas, Michael John, Ph.D., Professor, Soil Science
  - Verghese, Kuruvilla, Ph.D., Professor Emeritus of Nuclear Engineering, Nuclear Engineering
  - Veronese, Paola, PhD, Assistant Professor, Plant Pathology
  - Veronesi, Bellina, PhD, Adjunct Associate Professor, Toxicology
  - Vickery, Kenneth Powers, Ph.D., Associate Professor, History
  - Vilches, Elvira, PhD, Assistant Professor, Foreign Languages and Literatures
  - Vincent, Kenneth Steven, Ph.D., Professor, History
  - Viniotis, Ioannis, Ph.D., Professor, Electrical and Computer Engineering
  - Volk, Richard James, Ph.D., Professor Emeritus of Soil Science, Soil Science
  - von Haefen, Roger H., PhD, Assistant Professor, Economics
  - Vouk, Mladen Alan Velimir, Ph.D., Professor, Computer Science
  - Vukina, Tomislav, Ph.D., Professor, Economics
- 
- Wade, Robert W, PhD, Assistant Professor, Parks, Recreation and Tourism Management
  - Wages, Dennis P., D.V.M., Professor, Population Health & Pathobiology
  - Wagger, Michael Gary, Ph.D., Professor, Soil Science
  - Wahl, George Henry Jr., Ph.D., Professor, Chemistry
  - Wahls, Harvey Edward, Ph.D., Professor Emeritus, Civil Engineering
  - Waites, Cheryl, Ed.D., Associate Professor, Social Work
  - Walden, Michael Leonard, Ph.D., William Neal Reynolds Professor of Agricultural and Resource Economics, Economics
  - Waldvogel, Michael G., Ph.D., Assistant Professor, Entomology
  - Walek, Mary Louise, Ph.D., Associate Professor Emeritus of Sociology and Anthropology, Sociology and Anthropology

- Walgenbach, James F., Ph.D., Professor, Entomology
- Walker, Glenn M., PhD, Assistant Professor, Biomedical Engineering
- Walker, John T., PhD, Adjunct Assistant Professor, Soil Science
- Walker, Mark D, PhD, Associate Professor, Business Management
- Wall, John Nelson Jr., Ph.D., Professor, English
- Wallace, Andrew, PhD, Assistant Professor, Toxicology
- Wallace, James Macauley III, Ph.D., Associate Professor, Sociology and Anthropology
- Walsh, Rebecca Anne, PhD, Assistant Professor, English
- Walter, William M. Jr., Ph.D., Professor Emeritus of Food Science, Food Science
- Wan, Jan-Ru, MFA, Assistant Professor, Art and Design
- Wang, Huixia (Judy), PhD, Assistant Professor, Statistics
- Wang, Lingjuan, PhD, Assistant Professor, Biological and Agricultural Engineering
- Wang, Wenye, PhD, Associate Professor, Electrical and Computer Engineering
- Wang, Xiaogang, PhD, Adjunct Assistant Professor, Computer Science
- Ward, Donn R., Ph.D., Professor, Food Science
- Ward, Thomas, PhD, Assistant Professor, Mechanical and Aerospace Engineering
- Warr, Richard S, PhD, Associate Professor, Business Management
- Warren, Catherine A., Ph.D., Associate Professor, English
- Warren, Sarah Timberlake, D.F., Associate Professor, Multidisciplinary Studies
- Warsing, Donald, PhD, Assistant Professor, Business Management
- Waschka, Rodney A. II, D.M.A., Professor, Multidisciplinary Studies
- Washburn, Brian, PhD, Adjunct Assistant Professor, Forestry
- Washburn, Steven P., Ph.D., Professor, Animal Science
- Wasik, John Louis, Ed.D., Professor Emeritus of Statistics, Statistics
- Waters, Richard D, PhD, Assistant Professor, Communication
- Waters, William Meade Jr., Ph.D., Associate Professor Emeritus, Mathematics, Science, & Technology Education
- Watson, Benjamin Allen, PhD, Associate Professor, Computer Science
- Watson, David Wesley, Ph.D., Associate Professor, Entomology
- Watson, Gerald Francis, Ph.D., Associate Professor Emeritus of Marine, Earth and Atmospheric Science, Marine, Earth, and Atmospheric Sciences
- Watson, Larry Wayne, Ed.D., Associate Professor Emeritus of Mathematics, Science and Technology Education, Mathematics, Science, & Technology Education
- Wear, David N., Ph.D., Adjunct Professor, Forestry
- Weber, Jerome Bernard, Ph.D., Professor of Crop Science, Crop Science
- Wechsberg, Wendee M., PhD, Adjunct Associate Professor, Psychology
- Wechsler, Monroe S., Ph.D., Adjunct Professor, Nuclear Engineering
- Weed, Sterling Barg, Ph.D., Professor Emeritus of Soil Science, Soil Science
- Weeks, Willard Wesley, Ph.D., Professor Emeritus of Crop Science, Crop Science
- Weems, Kimberly S., PhD, Assistant Professor, Statistics
- Wegmann, Karl, PhD, Assistant Professor, Marine, Earth, and Atmospheric Sciences
- Wehner, Todd Craig, Ph.D., Professor, Horticultural Science
- Wehring, Bernard W., PhD, Research Professor, Nuclear Engineering
- Weinhold, Paul S., PhD, Adjunct Associate Professor, Biomedical Engineering
- Weisel, Deborah Lamm, Ph.D., Research Assistant Professor, Political Science and Public Administration
- Weiss, Ira R., PhD, Professor, Business Management
- Weissinger, Arthur K., Ph.D., Professor, Crop Science
- Weisz, P. Randall, Ph.D., Professor, Crop Science
- Welby, Charles William, Ph.D., Professor Emeritus of Marine, Earth and Atmospheric Sciences, Marine, Earth, and Atmospheric Sciences
- Welch, Milton Lamont, PhD, Assistant Professor, English
- Wellman, J. Douglas, Ph.D., Professor, Parks, Recreation and Tourism Management
- Wells, J. C., M.S., Professor Emeritus of Plant Pathology, Plant Pathology
- Wells, Janice Gross, PhD, Assistant Professor, Social Work
- Wells, Randy, Ph.D., Professor, Crop Science
- Welsch, Frank, Dr.Med.Vet, Adjunct Professor, Molecular Biomedical Sciences

- Wenig, Robert Emery, Ph.D., Associate Professor Emeritus, Mathematics, Science, & Technology Education
- Weninger, Keith R., PhD, Assistant Professor, Physics
- Wentworth, Thomas Ralph, Ph.D., Professor, Plant Biology
- Werner, Dennis James, Ph.D., Professor, Horticultural Science
- Wernsman, Earl Allen, Ph.D., William Neal Reynolds Professor Emeritus, Crop Science
- Wertz, Dennis William, Ph.D., Associate Professor Emeritus of Chemistry, Chemistry
- Wesler, Oscar, Ph.D., Professor Emeritus of Statistics, Statistics
- Wessels, Walter John, Ph.D., Professor, Economics
- West, Harry Carter, Ph.D., Associate Professor Emeritus of English, English
- West, Harvey A. II, PhD, Research Assistant Professor, Industrial Engineering
- Westerman, Philip Wayne, Ph.D., Professor, Biological and Agricultural Engineering
- Whang, Hyun Suk, PhD, Adjunct Assistant Professor, Textile Engineering, Chemistry, and Science
- Whangbo, Myung Hwan, Ph.D., Professor, Chemistry
- Wheatley, John H., Ph.D., Associate Professor, Mathematics, Science, & Technology Education
- Wheeler, Elisabeth Anne, Ph.D., Professor Emeritus of Wood and Paper Science and Forestry, Wood and Paper Science
- Wheeler, Mary Elizabeth, Ph.D., Professor Emeritus of History, History
- Whetten, Ross W., Ph.D., Associate Professor, Forestry
- Whipker, Brian E., Ph.D., Professor, Horticultural Science
- Whisnant, Charles Scott, Ph.D., Associate Professor, Animal Science
- Whitacre, Michael D., D.V.M., Associate Professor, Department of Clinical Sciences
- Whitaker, Thomas Burton, Ph.D., Professor (USDA), Biological and Agricultural Engineering
- White, Jeffery L., Ph.D., Associate Professor, Chemistry
- White, Jeffrey G., Ph.D., Associate Professor, Soil Science
- White, Mark W., Ph.D., Associate Professor, Electrical and Computer Engineering
- White, Raymond Cyrus, Ph.D., Professor Emeritus of Chemistry, Chemistry
- White, Robert Ernest, Ph.D., Professor, Mathematics
- Whitfill, Craig E., PhD, Adjunct Associate Professor, Poultry Science
- Whitlow, Lon Weidner, Ph.D., Professor, Animal Science
- Whitten, Jerry Lynn, Ph.D., Professor, Chemistry
- Wiebe, Eric N., Ph.D., Associate Professor, Mathematics, Science, & Technology Education
- Wiegmann, Brian Michael, Ph.D., Professor, Entomology
- Wieland, Bruce W., Ph.D., Adjunct Associate Professor, Nuclear Engineering
- Wiener, Russell W., Ph.D., Adjunct Associate Professor, Marine, Earth, and Atmospheric Sciences
- Wiessner, Colleen Aalsburg, EdD, Assistant Professor, Adult and Higher Education
- Wiley, Stephen B., Ph.D., Associate Professor, Communication
- Wilk, John Clark, Ph.D., Professor Emeritus of Animal Science, Animal Science
- Wilkerson, Gail Geier, Ph.D., Professor, Crop Science
- Wilkinson, Richard R., M.L.A., Professor Emeritus, Landscape Architecture
- Williams, Billy M. Jr., PhD, Associate Professor, Civil Engineering
- Williams, C. Michael, Ph.D., Professor, Poultry Science
- Williams, Christopher J., PhD, Adjunct Assistant Professor, Poultry Science
- Williams, Cranos M, PhD, Assistant Professor, Electrical and Computer Engineering
- Williams, James Oliver, Ph.D., Professor, Political Science and Public Administration
- Williams, Laurel E., DVM, Assistant Professor, Veterinary Medicine
- Williams, Laurie Ann, Ph.D., Associate Professor, Computer Science
- Williams, Linda R., MSW, Associate Professor, Social Work
- Williams, Mary Cameron, Ph.D., Professor Emeritus of English, English
- Williams, Paul F., Ph.D., Professor, Accounting
- Williams, Porter Jr., M.A., Professor Emeritus of English, English
- Williams, Sandra Wall, Ed.D., Adjunct Assistant Professor, Adult and Higher Education
- Williamson, John D., PhD, Associate Professor, Horticultural Science
- Willits, Daniel Hoover, Ph.D., Professor, Biological and Agricultural Engineering
- Wilson, Elizabeth Bundy, Ed.D., Associate Professor, Agricultural and Extension Education
- Wilson, James Reed, Ph.D., Professor, Industrial Engineering

- Wilson, John M., PhD, Research Assistant Professor, Electrical and Computer Engineering
- Wilson, Lorenzo George, Ph.D., Professor, Horticultural Science
- Wilson, Mark Alan, Ph.D., Associate Professor, Psychology
- Wilson, Richard Ferrol, Ph.D., Professor (USDA), Crop Science
- Wimberley, Ronald Coleman, Ph.D., William Neal Reynolds Professor, Sociology and Anthropology
- Winchester, Samuel C. Jr., Ph.D., Klopman Distinguished Professor Emeritus, Textile and Apparel Management
- Wineland, Michael J., Ph.D., Professor, Poultry Science
- Winner, William E., PhD, Professor, Forestry
- Winstead, Nash Nicks, Ph.D., Professor Emeritus of Plant Pathology and Provost and Vice Chancellor Emeritus, Plant Pathology
- Winston, Hubert, Ph.D., Associate Professor Emeritus of Chemical Engineering, Chemical Engineering
- Wise, Farrell C., Ph.D., Adjunct Assistant Professor, Horticultural Science
- Wise, George Herman, Ph.D., Professor Emeritus of Animal Science, Animal Science
- Wiseman, Angela, PhD, Assistant Professor, Elementary Education
- Wiser, Edward Hempstead, Ph.D., Professor Emeritus of Biological and Agricultural Engineering, Biological and Agricultural Engineering
- Wishy, Bernard W., Ph.D., Professor Emeritus of History, History
- Witt Frese, Mary Ann, Ph.D., Professor Emeritus of Foreign Languages and Literatures, Foreign Languages and Literatures
- Wogalter, Michael S., Ph.D., Associate Professor, Psychology
- Wohlgenant, Michael K., Ph.D., William Neal Reynolds Professor, Economics
- Wolcott, Donna Lee Riley, Ph.D., Associate Professor Emeritus, Marine, Earth, and Atmospheric Sciences
- Wolcott, Thomas G., Ph.D., Professor, Marine, Earth, and Atmospheric Sciences
- Wolfe, Barbara, PhD, Adjunct Assistant Professor, Veterinary Medicine
- Wolfinger, Russell D., PhD, Adjunct Professor, Statistics
- Wolford, Tonya, PhD, Assistant Professor, Foreign Languages and Literatures
- Wolfram, Walter Andrew, Ph.D., William C. Friday Distinguished Professor and Interim Department Head of English, English
- Wollenzien, Paul L., Ph.D., Professor, Biochemistry
- Wollum, Arthur George II, Ph.D., Professor Emeritus of Soil Science, Soil Science
- Woodard, Roger, PhD, Research Assistant Professor, Statistics
- Woodrum, Eric M., Ph.D., Professor, Sociology and Anthropology
- Woolard, Dwight L, PhD, Adjunct Professor, Electrical and Computer Engineering
- Wormsley, William, PhD, Associate Professor, Sociology and Anthropology
- Worsham, Arch Douglas, Ph.D., Professor Emeritus of Crop Science, Crop Science
- Wortman, Jimmie Jack, Ph.D., Professor Emeritus of Electrical and Computer Engineering, Electrical and Computer Engineering
- Wossink, Grada A., Ph.D., Professor, Economics
- Wright, Charles Gerald, Ph.D., Professor Emeritus of Entomology, Entomology
- Wright, R. Lorraine, Ph.D., Associate Professor, Accounting
- Wu, Fen, Ph.D., Associate Professor, Mechanical and Aerospace Engineering
- Wu, Justin Y.-T., PhD, Adjunct Professor, Mechanical and Aerospace Engineering
- Wu, Yichao, PhD, Assistant Professor, Statistics
- Wurman, Peter R., Ph.D., Adjunct Professor, Computer Science
- Wust, Valerie, PhD, Assistant Professor, Foreign Languages and Literatures
- Wyer, Mary Beth, Ph.D., Associate Professor, Psychology
- Wynne, Johnny Calvin, Ph.D., Professor, Crop Science
- Wynne, Randolph H., PhD, Adjunct Associate Professor, Forestry
- Wyrick, Deborah Baker, Ph.D., Associate Professor, English
- Xi, Lin, PhD, Research Assistant Professor, Animal Science
- Xia, Xin-Rui, PhD, Research Assistant Professor, Veterinary Medicine
- Xiang, Qiu-Yun (Jenny), Ph.D., Associate Professor, Plant Biology
- Xie, Deyu, PhD, Assistant Professor, Plant Biology
- Xie, Lian, Ph.D., Professor, Marine, Earth, and Atmospheric Sciences

- Xie, Tao, PhD, Assistant Professor, Computer Science
- Yamamoto, Yuri Takeshima, Ph.D., Research Assistant Professor, Forestry
- Yelverton, Fred Hinnant, Ph.D., Professor, Crop Science
- Yenko, George Craig, Ph.D., Associate Professor, Horticultural Science
- Yim, Man-Sung S., Ph.D., Associate Professor, Nuclear Engineering
- Yingling, Yaroslava G., PhD, Assistant Professor, Materials Science and Engineering
- Yoder, Jeffrey, PHD, Assistant Professor, Molecular Biomedical Sciences
- York, Alan Clarence, Ph.D., William Neal Reynolds Professor of Crop Science, Crop Science
- Young, Albert R., Ph.D., Professor, Physics
- Young, Carl A., PhD, Assistant Professor, Curriculum and Instruction
- Young, Eric, Ph.D., Professor, Horticultural Science
- Young, Gregory S., Ph.D., Associate Professor, Business Management
- Young, James Herbert, Ph.D., Professor Emeritus of Biological and Agricultural Engineering, Biological and Agricultural Engineering
- Young, Robert E., Ph.D., Professor, Industrial Engineering
- Young, Robert Michael, Ph.D., Associate Professor, Computer Science
- Young, Robert Vaughan Jr., Ph.D., Professor, English
- Young, Sidney Stanley, Ph.D., Adjunct Professor, Statistics
- Young, Tamara V., PhD, Assistant Professor, Educational Leadership and Policy Studies
- Youssef, Mohamed, PhD, Assistant Professor, Biological and Agricultural Engineering
- Yu, Donna Ginger, Ph.D., Assistant Professor, Electrical and Computer Engineering
- Yu, Jie, PhD, Assistant Professor, Civil Engineering
- Yu, Ting, PhD, Assistant Professor, Computer Science
- Yuan, Fuh-Gwo, Ph.D., Professor, Mechanical and Aerospace Engineering
- Yuter, Sandra, PhD, Associate Professor, Marine, Earth, and Atmospheric Sciences
- Zagacki, Ken, PhD, Professor, Communication
- Zahn, Margaret A., Ph.D., Professor, Sociology and Anthropology
- Zavada, John, PhD, Adjunct Assistant Professor, Electrical and Computer Engineering
- Zeldin, Darryl C., MD, Adjunct Professor, Toxicology
- Zeng, Zhaobang, Ph.D., William Neal Reynolds Professor, Statistics
- Zenkov, Dmitry, PhD, Associate Professor, Mathematics
- Zering, Kelly Douglas, Ph.D., Associate Professor, Economics
- Zhang, Daowen, Ph.D., Associate Professor, Statistics
- Zhang, Hao, PhD, Assistant Professor, Statistics
- Zhang, Xiangwu, PhD, Assistant Professor, Textile Engineering, Chemistry, and Science
- Zhang, Yang, PhD, Associate Professor, Marine, Earth, and Atmospheric Sciences
- Zhang, Zhe, PhD, Research Associate Professor, Mechanical and Aerospace Engineering
- Zhao, Jing, PhD, Assistant Professor, Business Management
- Zheng, Xiaoyong, PhD, Assistant Professor, Economics
- Zhirnov, Victor V., PhD, Adjunct Associate Professor, Materials Science and Engineering
- Zhu, Yong, PhD, Assistant Professor, Mechanical and Aerospace Engineering
- Zhu, Yuntian T., PhD, Associate Professor, Materials Science and Engineering
- Zia, Paul Zung-Teh, Ph.D., Professor Emeritus, Civil Engineering
- Zikry, Mohammed A., Ph.D., Professor, Mechanical and Aerospace Engineering
- Zimmer, Catherine Roberts, Ph.D., Adjunct Associate Professor, Sociology and Anthropology
- Zobel, Bruce John, Ph.D., Professor Emeritus of Forestry, Forestry
- Zonderman, David A., Ph.D., Associate Professor, History
- Zorner, Paul Steffen, Ph.D., Adjunct Professor, Horticultural Science
- Zorowski, Carl Frank, Ph.D., Professor Emeritus of Mechanical and Aerospace Engineering, Mechanical and Aerospace Engineering
- Zublena, Joseph P., Ph.D., Professor, No Dept. Abbr
- Zuckerman, Gilroy Joel, Ph.D., Associate Professor, Accounting
- Zuiches, James J., PhD, Professor, Sociology and Anthropology

## NC State Policies

North Carolina State University is committed to academic integrity, and all students are required to adhere to the [NC State Code of Student Conduct](#). Individual policies on conduct, including those listed below, are posted on [University Policies, Regulations, and Rules \(PRRs\)](#).

[University Patent Procedures](#)  
[Grievance Procedures for Graduate Students](#)  
[Code of Student Conduct](#)  
[Academic Integrity](#)  
[Policy on Illegal Drugs](#)  
[Sexual Harassment Policy](#)  
[Racial Harassment Policy](#)  
[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.



## 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](#)

## 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 \(2007-2008\)](#)  
[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 \(Fall 2003\)](#)